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INTER AVIA

Review of World Aviation

In this Issue:

International Co-operation? Opium for the People!
A Day at Britain's 1949 S.B.A.C. Flying Display and Exhibition
The Coming Crisis in U.S. Aviation
"Soviet Aviation Day, 1949" — Was Douhet Right?
Scholer Bangs: Not in the Script

VOLUME IV No 10 OCTOBER, 1949

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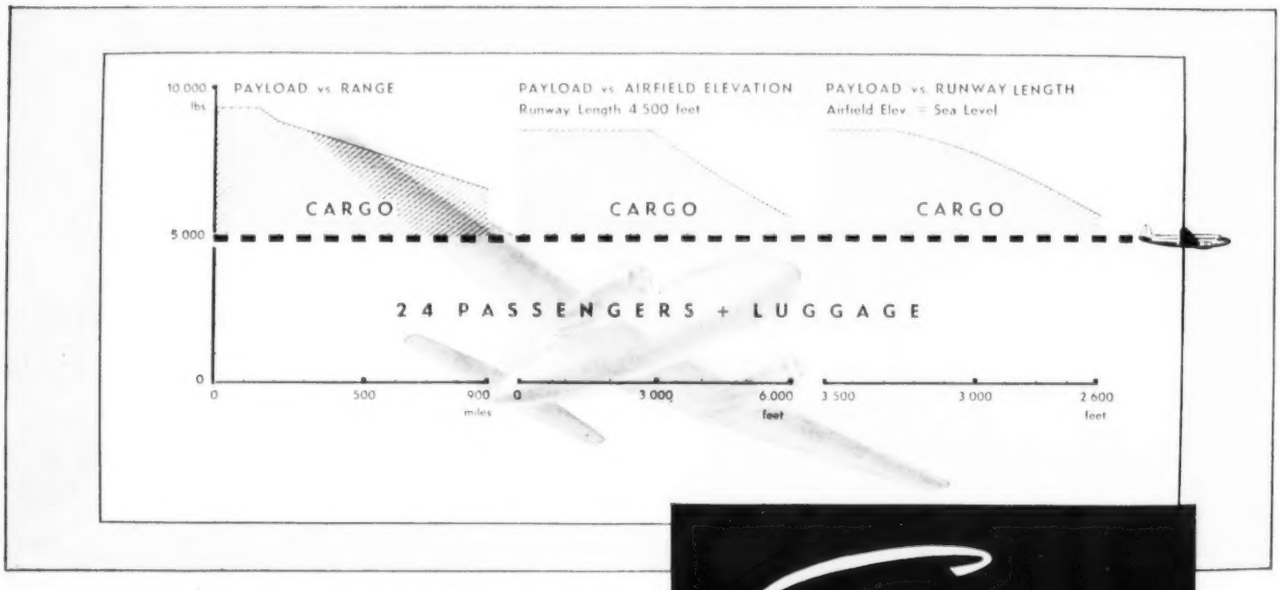

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INTERAVIA

Review of World Aviation

OFFICIAL ORGAN OF THE FÉDÉRATION AÉRONAUTIQUE INTERNATIONALE (F.A.I.)

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Front cover:

Handley Page "Hermes V" airliner, powered by four Bristol "Theseus" turboprops, at the S.B.A.C. Display, Farnborough (see p. 586).

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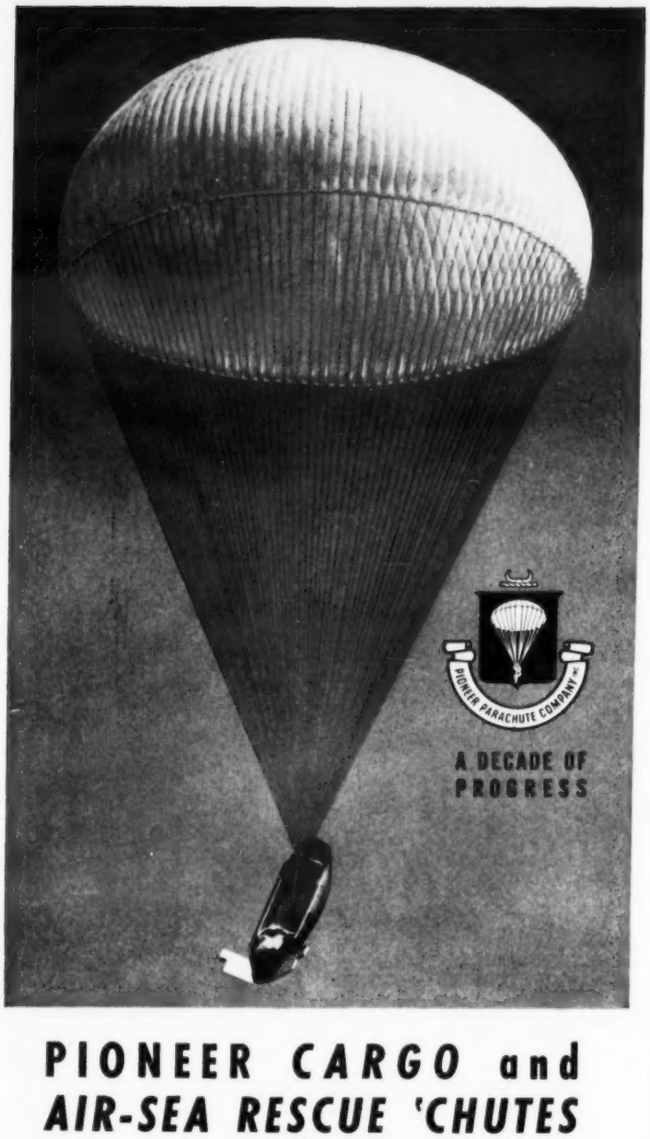

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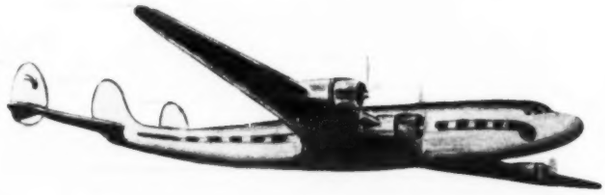

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International Co-operation ? — Opium for the People !

It is years ago. When attending international events before the war my path was nearly always crossed by a certain man connected with aviation, who was quite well known in those days. We had come to an agreement : one day we would jointly write a history of aviation. The title had already been chosen... " The Big Swindle. " In the meantime, my acquaintance and intended co-author has disappeared from the scene. The book has not yet progressed further than the title.

The late-summer days of last September reminded me of him. International events were being held again, but one found a multitude of new faces.

Between September 6th and 10th people from all countries converged on Britain's aeronautical centre at Farnborough to admire the latest creations of the United Kingdom's aircraft industry. A few days later, between September 12th and 16th, the top men of international civil aviation convened at The Hague to celebrate the thirtieth anniversary of their International Air Transport Association.

These two events had one thing in common : one spoke of international co-operation. Some believed in it, some felt an earnest desire for it, but somehow everything remained theoretical. In my mind arose my co-author presumptive of pre-war days...

* * *

There are moments when we wish to put matters aside and seek diversion. I pick up a book which has to do with aviation. Once again I page through the play written in the U.S.A. during the war by the exiled German poet, Carl Zuckmayer : *Des Teufels General*—" The Devil's General." If Zuckmayer's play were to be translated into many languages and given in many countries, it would probably contribute—more than many other things—to peace among nations. I am sure that many readers—apart from a few Germans and German-speaking Swiss—are unacquainted with this drama of the anti-Nazi General Harras. Here is a small sample, a brief excerpt from the play.

Air Force General Harras has under his orders a young officer whose intended betrothal came to an abrupt end " because of a vague branch in his family tree." Such things, it will be remembered, occurred in Hitler's Germany. The young officer's family comes from the Rhine. It is an old officers' family, " no suspicion of any Jewish blood, but a great-grandmother who cannot quite be traced." It should be emphasised again that the family comes from the Rhine.

> General Harras : " ...Begin by taking a look at your ancestry—since Christ's birth. There was a Roman captain, brown as a ripe olive, who taught Latin to a fair-headed girl... And then came a Greek physician, or a Celtic legionary, a Graubünden farmer, a Swedish horseman, a soldier of Napoleon, a Cossack deserter... then a fat shipper from Holland, a Magyar, a Viennese officer, a French actor, a Bohemian musician. All those people lived on the Rhine—brawling, drinking, singing, and producing children. And Goethe, he came out of the same pot ; and Beethoven, and Gutenberg, and Matthias Grünewald, and—Oh, well, look it up in the encyclopædia ! Those were the best, the best in the world. And why ?
>
> Because the nations mixed together — mixing like the water from springs, brooks and rivers, so as to become a mightly, living stream... "

That was international co-operation !

Let us now return to Farnborough and The Hague.

* * *

A few pages further on you will find a factual report on what the British aircraft industry had to offer at Farnborough. It contains the impressions of our engineers, who speak of Farnborough in enthusiastic superlatives—a rarity in their profession.

But should you wish to know what was not shown and not intended at Farnborough, then read these few words by one of the " special correspondents " sent by European continental newspapers to the S.B.A.C. show :

> " ... Because the design of the new de Havilland 106 Comet has been governed chiefly by considerations of commercial flying, its operation must be economical. No improvement in ground organisation procedures is necessary for its operation... "

This " special report " hits the nail on the—point. It says exactly the opposite of what should be said. The de Havilland " Comet " flies, certainly. But, apart from any question of its operational maturity, it cannot be put into airline service before the entire international ground organisation has been improved, and all airports developed and equipped with electronic aids permitting safe arrivals and departures under all weather conditions. For the time being we are a long way from that goal.

Such " special correspondents " have twisted matters to such an extent that even some airline executives really believe that the " Comet " has not only appeared in the sky but could start scheduled services over the Atlantic as soon as tomorrow. You're welcome to step aboard...

Let us call a spade a spade. The British aircraft industry, at its tenth Flying Display, staged a terrific act. It proved that what was yesterday a futuristic principle, is possible and applicable. It proved incontestably that airliners powered with gas-turbine engines are airworthy, capable of far greater speeds than those we are used to at present, and may be ready within two or three years for services on certain routes. But for such services the Britons themselves demand that airport traffic control pro-

The De Havilland D.H. 106 " Comet " four-jet airliner.

Air park at the 1949 S.B.A.C. Display. Extreme left : General Electric " Canberra. " Centre, front row : Armstrong Whitworth " Apollo. " Second row, left to right : De Havilland " Chipmunk, " " Dove, " " Vampire " with afterburner, " Vampire " night-fighter, " Venom, " " Comet. " Third row : Airspeed " Ambassador, " Vickers " Varsity, " " Seagull, " 510, " Viscount. " Fourth row : Avro " Shackleton, " Boulton Paul " Balliol 2, " Avro " Athena 2, " Handley Page " Marathon 2, " " Hermes IV, " " Hermes V. " Fifth row : Avro " Lancaster " powered with " Python " turbo-props, Westland " Wyvern 2 " (behind it, Cierva " Air Horse " and Percival " Prince "), etc.

cedures be thoroughly revised beforehand. Technologically, the new engines are far ahead of the ground installations.

This setback can in no way lessen the merit earned by Britain's aircraft constructors. Last September they exhibited sixty-one different aircraft, twenty-four of which were powered with ultra-modern gas-turbine engines of one kind or another. Hats off !

Thus, the President of the S.B.A.C., Sir Roy H. Dobson, was able to declare with justified pride in his dinner speech of September 6th : " ... I would mention the lead which the British aircraft industry has given to the world in the development and utilisation of the gas-turbine engine... " With well-placed modesty he added : " ... We would like you to regard our Display and Exhibition as a kind of hors-d'œuvre, and to realise that there is more to follow." Sir Roy did not beat about the bush when he said : *" Now, the British aircraft industry is anxious to sell its products abroad."*

Does this signify anything other than that Britain's aircraft industry is now determined and prepared to co-operate as closely as possible with other countries ?

On what basis ?

There will be no basis until old methods are abandoned, nationalistic sentiments swept aside, and *do ut des* methods applied.

Old methods ? I shall never forget how, before the war, I made an enemy of an English friend. He held a very good position in an important petroleum concern. Our conversation had reached a point where we were both deploring the fact that the British airline business was losing ground—that was in 1937—because of the lack of suitable flying equipment. Innocently, I made the *faux pas* of asking why the British did not buy Douglas DC-3s. The farewell was more than frosty... A British air transport company buying American aircraft ? Buy British... But at present my conscience is relieved. Since 1939 American aircraft, too, have flown under the British flag.

People have now become more broad-minded, and the President of the S.B.A.C. has every right to be hopeful. Every day one hears and reads that even the Americans are interested in Britain's newest constructions. And why not ? The Americans buy huge quantities of English cloth, Scotch whisky, French perfume and champagne. Why should they not start buying British aircraft engines. Only, one should not hurt their deepest feelings. Just as Britons are proud of their royal dynasty, Americans are inordinately proud of being the world's greatest industrial power.

Before the war I had the bad luck to speak of American aircraft to an Englishman. I probably was clumsy ; the British salesmen probably will be less clumsy. Anyhow, it is to be hoped that they will not behave like the hypothetical Englishman purported to have called on the editor of the *New York Times* a short while ago :

> " I say," the Briton exclaims, " isn't it amazing to think of poor old England blundering into the lead in the air age ? " The visitor's ruddy complexion grows ruddier and his glittering eyes glitteringer. " Wasn't it only a couple of months ago that your industrial fellows were generously clubbing together to send a mission over and teach the doddering British your industrial—ah—know-how ? Was one of that expedition an aircraft manufacturer, by any chance ? If there was one, he certainly must have been a genius at communicating your—ah—know-how." And the visitor concludes : " Are you accusing me of being witty ? You must know that as an Englishman I simply don't know how."

Important men in British aviation meet at Farnborough. Recognisable are Sir Roy H. Dobson, Marshal of the R.A.F. Lord Tedder, Lord Brabazon of Tara, Sir Frederick Handley Page (extreme right).

It is not hard to imagine how bewildered the Americans must be feeling. It is with extreme reluctance that one entertains an inferiority complex towards one's debtors... The important thing is how to co-operate; here is the basis !

To acclaim the " Comet " as the Eighth Wonder of the World would be a slight exaggeration. American airliners are not yet ready for the scrap-heap. But it is very safe to imagine firms such as Boeing, Douglas, Lockheed or Convair utilising British turbojets or turboprops, either buying them in Great Britain or building them under licence in the U.S.A.

* * *

Impressed by what they had seen at Farnborough, the leaders of international civil aviation betook themselves to The Hague in order to discuss their plans in a family atmosphere.

The reception given them in Holland was more than cordial. Guests were greeted by Prince Bernhard of the Netherlands, the Minister of Transport, the town fathers of the Hague, and K.L.M.'s Dr. A. Plesman. Main theme of the talks ? International co-operation in civil aviation, co-operation at all costs in order to make airline services effective, airline companies profitable.

Honours were conferred the very first evening of the meeting. Airline personalities—Sweden's Per A. Norlin, France's René

Briend, Britain's J. R. McCrindle, Belgium's Gilbert Périer—sported the glittering Commander Cross of Orange-Nassau. Airline executive No. 1, Pan American Airways' Juan Terry Trippe was also awarded this high honour— but " by proxy." People awaited his arrival in order to make up for a missed occasion. Namely, Trippe entered IATA in 1938 as the first American member, and was due to assume the Association's presidency in 1939. The Austrian corporal upset that plan.

And today ? Optimistic Europeans saw in Trippe the coming IATA President for 1950/51, and probably had prepared a banquet speech to fit the occasion. But as it was, Trippe came, saw—and thanked. His colleagues from the New World had for a moment forgotten the words of their Netherlands host. Co-operation ? But only within limits. Were they afraid of Trippe ? All that we can do is to wish the best of luck to the next IATA President, Warren Lee Pierson, Chairman of Trans World Airline, a lawyer and banker.

Well, what did The Hague talks yield in the way of practical contribution towards co-operation in civil aviation ?

K.L.M.'s President, Dr. Plesman, made another bid for the much dreamed-of but still dreamlike " Fifth Freedom of the Air " without which, he opines, international operations can be nothing but patchwork. Down with bilateral agreements, up with the Multilateral Agreement ! The patriarch of civil air transport went on to show clearly that any agreement is nothing but a worthless bit of paper unless it is concluded in the right spirit, the spirit of sincere co-operation.

Outside their home frontiers, away from their national bureaucracy, warmed by Holland's Bols, the airline executives found courage : a war-to-the-death was declared against customs and passport officials ; a

The International Air Transport Association meets in the Peace Palace at The Hague. Left to right : retiring IATA President Gilbert Périer, President of Sabena ; Sir William P. Hildred, IATA Director-General ; Prince Bernhard of the Netherlands ; new IATA President Dr. A. Plesman, President of K.L.M. ; Netherlands Transport Minister Spitzen.

death blow—at least on paper—was delivered against all red-tapists. The Director-General of the French Post Office Administration received a special laurel wreath when he promised civil aviation a golden age in which all letters throughout the world would be carried by air without surcharge. Everybody agreed that, for air transportation to become popular and profitable, it must be made accessible to the man-in-the-street. And IATA's Director-General ended the ball by prophesying a kind of peaceful migration of peoples along the airlanes from continent to continent.

Was that not enough ? The atmosphere could not have been more cordial, everybody returned home filled with the best intentions. The spirit was willing, but the flesh is weak...

* * *

To quote Zuckmayer again : " ... mixing like the water from springs, brooks and rivers, so as to become a mighty, living stream... "

Farnborough could be the signal. If, in coming months, the star products of the British aircraft industry could mix—at devalued prices !—with those of other countries, then the devaluation of the pound would not be in vain. Then a new spirit would pervade the field. Then supernationalism and economic egoism would be obsolete concepts. Then the world's markets would be thrown open to British gas turbines and jet aircraft. Then many countries, notably the small ones, would be relieved of that ridiculous desire to manufacture everything themselves, better than their neighbours. Then, for the benefit of national economy, there would be no such slogan as " Buy British," but simply : Buy the best, the product which gives you the best value for your money, no matter where you find it ! Then the customs barriers would collapse of their own accord, opening the doors to industrial co-operation.

And civil aviation ? Would it not follow essentially the same pattern ? Then we would no longer find every company flying to all sorts of places to which it is attracted by misguided national pride, where it does not earn much but rather risks losing a lot. Then we would see continental and intercontinental routes distributed among companies in a way which falls in line with the concept of " Freedom of the Air." Then many a customs official would be out of a job and many airline presidents would no longer scare their smaller colleagues. Then it would be possible to lower the tariffs, make air travel a normal thing for the man-in-the-street, release the currently struggling airline companies from the shackles of bureaucracy.

Such is the spirit of a new era as painted by Plesman.

E.E.H.

Honours at The Hague. Left to right : Per A. Norlin, President of A.B. Aerotransport, the Swedish airline company ; Major J. R. McCrindle, Managing Director (External Affairs) of British Overseas Airways Corporation ; Holland's Transport Minister Spitzen, René Briend, Assistant Managing Director and Commercial Manager of Air France ; Gilbert Périer, President of Sabena.

International Co-operation : Aeroplanes under severe " icing conditions " — smiling faces. From left to right : Sir William P. Hildred, IATA's Director-General ; Dr. Albert Plesman, President-Director of K.L.M. Royal Dutch Airlines ; Gilbert Périer, President of Sabena ; Juan T. Trippe, President of Pan American Airways. In foreground, Dr. D. Goedhuis, at present exercising the functions of Civil Air Attaché at the Netherlands Embassy in London.

A Day at Britain's 1949 SBAC Flying Display and Exhibition

The Engineers' Report

Did you ever attend one of those shows which, since 1946 again, each year attracts crowds of aviation professionals of all countries to London ? Shows ? Well, not as festive as a Bayreuth or Edinburgh festival, not as gay as a Riviera carnival... Each day begins with the need for you to arise somewhat earlier than you would on a casual trip to London. If you are lucky enough to find accommodation in a hotel which is not too feudal, you can nevertheless celebrate the ritual of the English breakfast, with porridge, fish, toast, marmalade, and so forth—as is the case for most rituals, in the traditional manner but, in line with the times, with somewhat depleted contents. While taking a few steps to breathe in the air of the big city, you affix to your buttonhole a certain rectangular or round card and, full of your own importance, sink back, without having to think of buying a ticket, in a seat of one of the green buses stationed for your convenience after eight o'clock at Leicester Square. It carries you from traffic light to traffic light through endless quarters of the big city ; rolls later along a wide highway, leading past big, modern factories bearing familiar names ; takes you past the growing airport at Heath Row and gives you a fleeting glimpse of the four-engined aircraft parked there—from " Lancastrians " to " Stratocruisers " ; winds through the narrow streets of the township of Staines, over its Thames bridge... Finally, the landscape becomes a pleasure to the eye, but the way ahead is just as long again, until, after one and a half hours' driving, the bus follows around a green-painted, corrugated iron wall and comes to a stop between weather-beaten hangars fringing an airfield.

You are at Farnborough, the home of the Royal Aircraft Establishment, centre of Britain's aeronautical research. Perhaps you have already had occasion to capture something of its atmosphere from Nevil Chute's *No Highway*. Perhaps, then, more than once during the day you will recall, with a slight uneasy feeling, this book which illuminates the worries and hopes of the British aircraft industry from that human background without which it cannot be fully understood. Who knows whether the author, in his story of the development of his " Rutland Reindeer ," may not have described the destiny awaiting one or the other of the prototypes standing before you ?

But there is no time for day-dreaming. Arranged in neat rows for your delectation are about fifty different aircraft types—the best and newest the British aircraft industry has to show. It is already past ten o'clock. At midday instructions will be issued over the loudspeaker to clear the air park. Hardly two hours in which to take a close look at those types in which you are interested. Out with the catalogue !

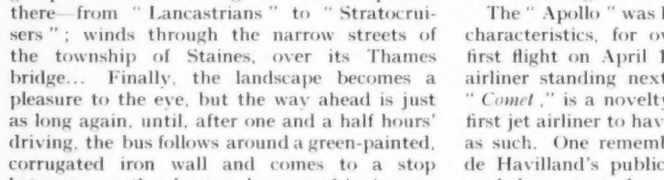
As star turn of this year's show the Society of British Aircraft Constructors has announced airliners powered by turboprops and turbojets. There they are, one behind the other. The first in the row is the *Armstrong Whitworth A.W.55 " Apollo "* medium-range airliner, equipped with a pressurised cabin for 24 to 40 passengers. Four Armstrong Siddeley " Mamba " turboprops, in slender nacelles protruding far in front of the wing, drive three-blade propellers and eject their exhaust gases, to create additional thrust, rearwards through nozzles over the wing's trailing edge.

The " Apollo " was known, by name and chief characteristics, for over two years before its first flight on April 10th, 1949, but the sleek airliner standing next to it, the *de Havilland " Comet ,"* is a novelty unique of its kind—the first jet airliner to have been designed originally as such. One remembers the stages by which de Havilland's publicity department has succeeded, up to today, in arousing the interest of aviation circles without disclosing any essential technical detail which might be useful to competitors. That a jet airliner to be known as the D.H.106 was in the design stage, was known in 1946 ; during the summer of 1947 the power plant—four de Havilland " Ghost " turbojets—and when the first flight would probably take place—1950 (!)—was mentioned ; and about six months later the name " Comet " was disclosed. After that, the excitement was nourished by carefully dosed-out " indiscretions ," though without revealing whether there was any truth in the popular rumour that it resembled the D.H.108 " Swallow " all-wing research aircraft. The first flight took place, sooner than was expected, on July 27th, 1949. During the subsequent six weeks up to the time of the S.B.A.C. show, the " Comet " logged no less than forty hours in the air, without revealing a single flaw. But even up to today, the manufacturers have disclosed neither dimensions nor weight characteristics, not to speak of design performance data. Enough to make many people curious, to entice the most blasé of airline executives to visit Farnborough and eventually the factory at Hatfield—in order to sign " optional purchase orders."

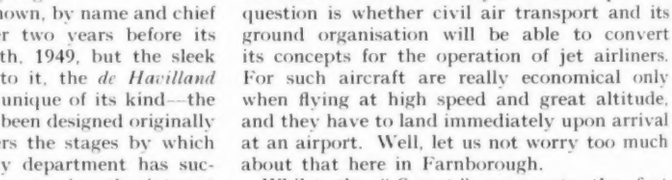
Indeed, there is little one can say about this aircraft which, even as we stand before it, continues to guard its secrets. Externally, its contours appear to be a successful compromise between high aerodynamic quality and structural utility. On the whole, the designers do not seem to have wandered very far from the classical concepts, despite the novel nature of the aircraft. But even as the projected long and thorough test programme guarantees the ultimate success of this airliner, this alone will not decide as to its utility ; the all-important question is whether civil air transport and its ground organisation will be able to convert its concepts for the operation of jet airliners. For such aircraft are really economical only when flying at high speed and great altitude, and they have to land immediately upon arrival at an airport. Well, let us not worry too much about that here in Farnborough.

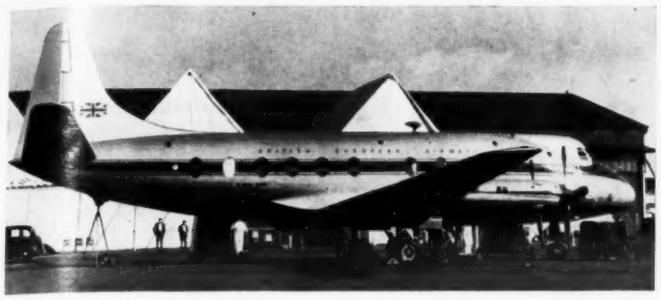
Whilst the " Comet " represents the first prototype of a jet-propelled airliner, the *Vickers Armstrongs " Viscount "* claims the parallel honour among turboprop-driven commercial transports. Demonstrated last year at Farnborough, it now bears the colours of British European Airways, who, after much delay, finally decided to order a few units of the enlarged " Viscount 700 " production version. It is to replace the old " Viking " medium-range type, which we still remember from yesterday's trip over to London. A stroll

Armstrong Whitworth's " Apollo " airliner, powered by four Armstrong Siddeley " Mamba " turboprops (1,010 e.s.h.p. plus 310 lbs. residual thrust), designed to cruise at 275 m.p.h. at 20,000 ft., with a 7,500-lb. payload over a range of over 1,000 miles.



De Havilland " Comet " four-jet airliner, first of its kind and prototype of a series of fourteen now under construction for British Overseas Airways Corporation. Definitely the main attraction of this year's S.B.A.C. Display, the " Comet " provides accommodation for thirty-six passengers.





Prototype Vickers Armstrongs "Viscount" airliner, powered by four Rolls-Royce "Dart" propeller-turbines (1,400 e.s.h.p.). The larger "Viscount 700" production type is intended to carry 40 to 55 passengers over routes of more than 1,000 miles, at a cruising speed of 310 m.p.h.

The Percival "Prince" survey aircraft has an observation post in the lengthened nose. From there, the chief photographer can operate the cameras, which are installed in the main cabin under observation of the radio operator.

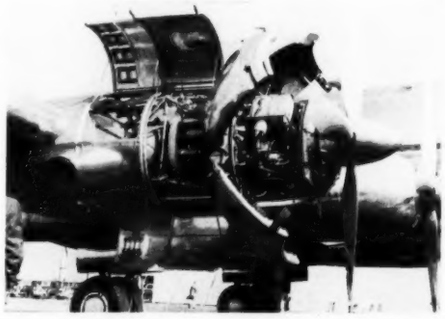
through the "Viscount's" cabin indeed promises far more comfortable travelling conditions. The front seat gives a view through a large oval window along the wing, over disappearingly small engine nacelles where yesterday a mountain of cowlings met the eye; the piston engines' earsplitting roar will be replaced by the gentle hum of four Rolls-Royce "Dart" turboprops; the propeller will no longer send its deafening clatter through the cabin wall. Contrary to the "Apollo," here the exhaust gases are not used for additional thrust, but are ejected beneath the wing, away from the fuselage.

Number four in the list of new turbine airliners is the *Handley Page "Hermes V,"* a turboprop (four Bristol "Theseus" engines of 2,540 e.s.h.p.) version of the "Hermes IV" type being produced for British Overseas Airways Corp. Apart from the power plant, it does not differ externally from the piston version, but in reality it has been considerably reinforced to cope with the greater fuel supply and take-off weight, and the higher speed. The "Hermes V" made its first flight on August 23rd, only two weeks before the show.

The opportunity is favourable for a visit to the "*Hermes IV.*" Its power is furnished by four Bristol "Hercules 763" air-cooled fourteen-cylinder twin-row radials, each giving 2,100 h.p. take-off power. The development story of the "Hermes" series is a long one—it began during the war, with the design of the "Hermes I," prototype of the "Hastings" military transport with tail-wheel undercarriage, used on the Berlin Airlift. A pressurised cabin and nose-wheel undercarriage have meanwhile made the "Hermes" into an external counterpart of the Douglas DC-6 and Lockheed "Constellation," but its range and, at least for the "Hermes IV," its speed, are inferior to those of the U.S.types. So far, not a single production type has reached airline service, so that the "Hermes" can only be expected to appear as a transitional type between the Avro "York" or Short "Solent" and—perhaps—the de Havilland "Comet" or Bristol 175 on B.O.A.C.'s eastbound Empire routes.—One is tempted to see in this aircraft an elementary example of the modest results a nevertheless experienced aircraft firm can attain if it accedes with more patience than initiative to the wishes of its only customer, the government.

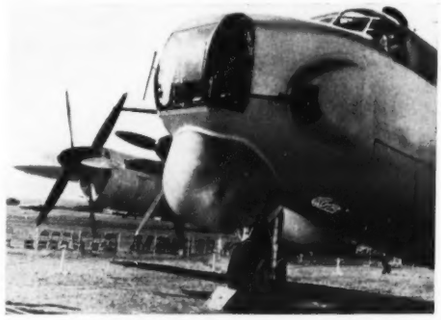
Both new versions of the "Hermes" are equipped to seat 40 passengers, although the pressurised cabin could accommodate about 70, and promise plenty of room and comfort—a tradition originally forged by Britain's flying-boats. Here and there, notably from the novel type of illumination in the cabin, one notices the non-aeronautical hand of an "interior decorator" who appears to ignore such things as "negative *g*" gusts. And the cockpit, equally comfortable, provides plenty of accessibility but does not seem to have all its instruments—for example, we cannot find the ILS cross-pointer on the pilot's panel.

Another turbine aircraft! The Handley Page lot includes the "*Marathon II*" transport, originally constructed by the now defunct Miles firm. This high-wing monoplane, accommodating about 20 passengers and powered with two "Mamba" turbines driving three-blade propellers, was first flown on July 23rd, 1949. The exhaust pipes follow the upper contour of the wing and eject the gases rearwards and slightly downwards. Further at the back there is another old acquaintance, the "*Marathon I*" prototype fitted with four 330-h.p. de Havilland "Gipsy Queen 70" reciprocating engines.



A Bristol "Theseus" turboprop of the four-engined Handley Page "Hermes V" long-range commercial transport. The aircraft's absolute range with full payload of 14,600 lbs.(40 passengers plus freight) is estimated at 1,800 miles; average cruising speed, 333 m.p.h. at 30,000 ft.

Showing the nose of the heavy four-engined Avro "Shackleton" reconnaissance aircraft. In the plastic turret are the radar antenna and two 20-mm. cannon, one on either side; two more 20-mm. cannon are mounted in a dorsal rotating turret, and two 0.5-in. machine guns in the tail.



Other piston-engined commercial transports, exhibited in previous years, are back again.

The twin-engined *Airspeed "Ambassador"*—it is the prototype of the production model with pressurisation—has the Air Registration Board's certificate for a maximum weight of 45,000 lbs. and is equipped to seat 36 passengers. Before the take-off weight is raised to the projected—and in test flights already attained—52,000 lbs., the wing structure has to be modified a little; moreover, the large cabin will be fitted with additional seats for medium hauls.

A quick inspection of the smaller twin-engined types—the *Percival "Prince,"* which has finished its test programme and is now being offered as a survey aircraft as well as an eight- to ten-passenger feeder transport; the *Bristol "Wayfarer," Short "Sealand"* and *de Havilland "Dove"*—and we have seen everything the British aircraft industry has to show in the way of commercial transports.

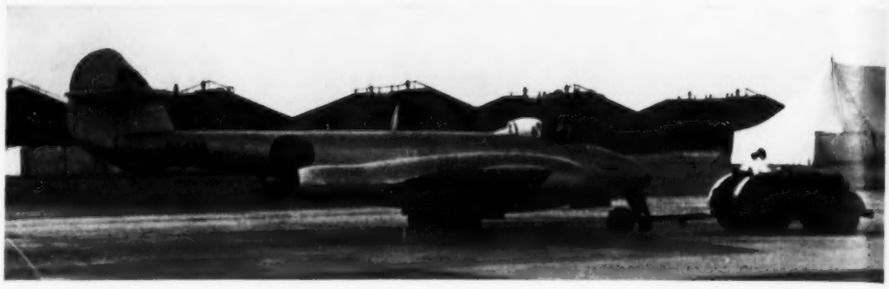
* * *

It is now the turn of the military aircraft. But time has flown; it is impossible to see them all this morning. And yet there is more worth seeing than in previous years—when the air park was cluttered with piston-engined types of the immediate post-war period. The exhibitors have cleared all that away: apart from half-a-dozen types discretely stationed in the background, the park looks very modern—or nearly so. For over there stands, like some posthumous descendant of a great aircraft, the four-engined *Avro "Shackleton"*; its lines do not seem to confirm the fact that this long-range reconnaissance member of the "Lancaster" family made its first flight only last March. Destined for operation by R.A.F. Coastal Command, it has radar equipment for night and bad-weather flying. Its four Rolls-Royce "Griffon" engines of nearly 2,500 h.p. make it Britain's most powerful piston-engined aircraft. For combating unescorted sea targets, it will be able to carry a considerable load of bombs.

It is difficult to imagine a bomber contrasting more with the "Shackleton" than the "*Canberra,*" a twin-jet bomber completed two months later by *English Electric Co., Ltd.*, a firm which has had plenty of experience in building fighters ("Vampires," for example) and has now ventured to build something of its own design. A mid-wing monoplane for a two-man crew—the radio-operator cum bomb-aimer sits behind the pilot and has no view outside—the "Canberra" features no antenna or other protuberance disturbing the air flow; wing and empennage join without transitional cowling or fairing on to the slender, round fuselage. Also noticeable are the square-cut

top of the fin-and-rudder unit, and the short undercarriage legs. The " Canberra " is driven by two Rolls-Royce " Avon " turbojets, each yielding some 7,500 lbs. static thrust.

Other newcomers include the *Westland " Wyvern T.F.2 "* torpedo-fighter, which looks and probably flies better with the Armstrong Siddeley " Python " turboprop of 3,670 e.s.h.p. —plus 1,150 lbs. residual thrust—than with the 3,500-h.p. Rolls-Royce " Eagle " powering the original T.F.1 version. Two " Pythons " are also to be found mounted on a " flying test bench," consisting of an Avro " Lancaster "



The thrust-augmenting afterburner installation is recognisable from the lengthened jet pipe. A Gloster " Meteor 4 " (shown here) and a de Havilland " Vampire " were specially fitted in this manner at Farnborough.

Westland " Wyvern " torpedo fighter, now turbo-prop-powered.

Two Armstrong-Siddeley " Python " turboprops experimentally replace the outboard engines of a four-engined Avro " Lancaster " bomber.

Experimental version of a Gloster " Meteor " powered with two Rolls-Royce " Avon " turbo-jets, whose total thrust of about 15,000 lbs. approaches the gross weight of the aircraft.

De Havilland D.H.113, two-seat night-fighter version of the " Vampire."

Delta-wing Avro 707, high-speed research type.

with two of its piston engines replaced by the turboprops.

And now for the jet fighters ! There are three new test versions, or developments, of each of Britain's two " classical " jet fighters—the *Gloster " Meteor "* and *de Havilland " Vampire."* Of each type there is one equipped, for demonstration, with an afterburner in the tail-pipe. This installation enables additional fuel to be burned with the excess air contained in the exhaust gases—combustion efficiency being bad, but producing plenty of additional thrust. Moreover, Gloster is staging the first public showing of the *" Meteor 8,"* which has a more slender nose section, a larger fuel supply and a different empennage shape than the proven " Meteor 4." The third one is the *" Avon-Meteor "* (two Rolls-Royce " Avon " turbojets), the most powerful single-seat fighter in existence.

Among the de Havilland exhibits is the *D.H.113 " Vampire "* night-fighter which, like the corresponding version of the old " Mosquito," has two staggered seats. The ordinary " Vampire " can be converted into a D.H.113 by adapting a special fuselage nose portion. Then there is one of the big surprises of the show, the *D.H.112 " Venom,"* developed from the " Vampire " and powered by a " Ghost " turbojet furnishing at least 5,000 lbs. maximum static thrust. The wing features a new, simpler plan-form : swept-back leading edge, straight trailing edge, square-cut tips.

Hawker and Vickers Armstrongs (Supermarine), creators of the " Hurricane " and " Spitfire," are each exhibiting two jet fighters, one of which is familiar : the *Hawker naval fighter* completed two years ago, and its *Vickers " Sea Attacker "* counterpart, each powered by a Rolls-Royce " Nene " and featuring straight wings.

But newcomers are their swept-wing versions, the *Hawker P. 1052* and the *Vickers Supermarine 510*. It is said of both that they can exceed the speed of sound in a dive.

And now for another surprise (there is no end to them this year !)—the *Avro 707* high-speed research aircraft. What sort of research, whether it is expected to cross the sonic barrier —secret ! Engine power—unknown ; all we can discover is that the air inlet atop the fuselage, divided by the fin, leads to a Rolls-Royce jet engine ; the jet outlet is in the tail. The wing is triangular and carries elevators on its straight leading edge, one either side of the fuselage, and further outboard carries ailerons—thus a kind of swept-wing aircraft in which the elevator unit merges with the wing. Also, the fin-and-rudder unit slopes backwards.

There goes the signal : " Attention please ! Visitors are requested to leave the air park, as the aircraft are now being moved."

We withdraw leisurely to the edge of the field, sit down and take another at look the aircraft as they are being rolled to the far side of the airfield. Over there, the first turbines are already sending out their shrill whine, warming up in readiness for the afternoon's flying display.

* * *

Lunch ? It suffices to take one look at that long queue of visitors before the official restaurant, waiting for a slice of cold chicken and some salad. The London breakfast ought to see us through—we'll probably be able to dig up a sandwich and a glass of beer later on. Right now, the moment is favourable for a visit to the exhibition marquee.

At twenty large stands, aircraft and engine constructors have models and samples of their products ; salesmen are ready to discuss their activities and plans. And at 167 smaller but no less interesting stands, manufacturers of accessories and equipment, component parts and structural materials are advertising their wares. It would take days to visit them all ; to mention individual ones would be to place at a disadvantage those who do not bring their prize products from beneath the counter until a serious customer engages them in conversation. Rather than expensive, eye-catching exhibits, one finds evidence of that reliability and high quality that has always hallmarked British products.

The best plan is to stick to the aircraft and engine firms, in so far as they are not already out on the field. *Saunders-Roe Ltd.*, who are building three flying-boats of the " Princess " class on the Isle of Wight, are exhibiting one in model form and hope to have the first of these ten-engined giants completed by 1951. *Blackburn & General Aircraft* are exhibiting a model of their still unfinished " Universal " freight transport. The *Ministry of Supply* has on show a 20-foot-long rocket missile whose top speed is 40 per cent. over the sonic barrier, and several other samples of its manifold development and research activities.

At the stand provided by *A. V. Roe & Co.* there is a model of the *" Tudor 9,"* a research aircraft powered by four Rolls-Royce " Nenes." Several units are under construction which will enable various establishments and firms to inspect the behaviour of structural parts and equipment under the severe conditions prevailing at 40,000 feet altitude.

On the whole, however, the British aeronautical firms allow one to discover surprisingly little as to their plans. That they keep quiet about new military aircraft is understandable enough—and it is natural that new prototypes should be announced only when they have flown. But British commercial transports of the next few years probably will represent developments of existing prototypes (including the *Bristol 175*, a much smaller derivation of the " Brabazon "), versions powered with tur-

bine engines, or featuring different numbers of seats, different interior layouts. For these, the ultimate decisions lie with the airline companies—" If they only could make up their minds " is what you hear everywhere, from which one notices not only the impatience of the salesmen waiting for orders but also the unsure design specifications with which the engineers have to cope : " They don't even know whether they want an aircraft for 20 or 40 passengers..."

Engines ? Nothing new either, or at least nothing released for public knowledge. The *Rolls-Royce " Avon," Armstrong Siddeley " Sapphire "* (a higher thrust development of the Metrovick " Beryl ") and " *Adder* " (pure jet counter-part of the " Mamba "), etc., are still on the secret list or are not yet being discussed by their manufacturers' publicity departments. At most we can discover that, in addition to *Armstrong Siddeley*, who have their " *Double Mamba*" on show (two " Mambas " combined through one gearbox—already exhibited in Paris last summer), *Napier* is working on a " *Coupled Naiad,*" of which the height does not exceed the diameter of the individual engine.

There is, however, one novelty in the power plant department which simply must be seen : the *de Havilland " Sprite " assisted take-off rocket*. This is a liquid rocket unit designed for general application, and notably for the " Comet " in which it is intended to fit one unit between each pair of turbojets. An 80 per cent. solution of hydrogen peroxide is fed under pressure to a chamber where, under the influence of a catalyst (permanganate solution), it decomposes and leaves the unit as a hydrogen-oxygen mixture through the rear nozzle. The unit, which weighs 350 lbs. empty and gives 5,000 lbs. thrust during nine seconds, is not jettisoned after use but can, thanks to a special trolley designed for the purpose, be recharged when the aircraft comes in to land.

* * *

Half past two—the flying display is due to begin. Through the thunder of the piston engines the whistling of the gas turbines penetrates our ears, and our noses tell us that, after the era of castor oil and that of the more neutral gasoline vapours, good old lamp oil is back in the air once more.

The *Vickers " Viscount "* is on the runway, its turbines warming up ; it speeds forwards, lifts, rises above the horizon, and in the distance starts banking to port. It is soon followed by the massive " *Hermes IV*," the " *Freighter* " (loaded with a field gun and a jeep)—both with thundering piston engines—and the majestic, quieter " *Ambassador*." Over towards the left the " Viscount " can be seen returning ; only one of its turbines is running—it loses a little height, but gains it again before the other three engines are re-started. The " Hermes," with two engines cut, banks over the spectators ; the " Freighter " and " Ambassador " show what they can do on one engine. After another flight around the field the four prototypes come in one after the other, flaps and wheels lowered—touch down and taxi to a stop. The " Ambassador " comes to a standstill with its engines running and propellers reversed, taxies backwards—further and further backwards, like an automobile—curving away from the runway, then forwards again... Here's a four-engined commercial flying-boat, a *Short " Solent "* of B.O.A.C., flying very low over the field and the spectators—an annual and always spectacular visitor to S.B.A.C. shows.

A mixed collection of smaller aircraft is ready to take off. There they go, one after the other : the *Boulton Paul " Balliol 2 "* and *Avro " Athena "* trainers, both making plenty of noise ; the quieter " *Prince*," " *Dove* " and " *Sealand* " feeder transports, and the odd looking *Vickers Supermarine " Seagull "* naval amphibian. They are followed by an old *Fairey " Firefly 5 "* which, with a bang and a prolonged hiss, quickly rises under the propulsion of four assisted take-off rockets, and shoots skywards. The aircraft show what they can do, come in to land.

In the meantime a queer looking monster has risen vertically into the air : the seemingly shapeless *Cierva " Air Horse "* three-rotor helicopter. It hovers, circles, descends, ascends again—doubtlessly a vehicle which lives up to its name and will prove its usefulness in more ways than one. Dwarfed by its big brother, the two-seat " *Skeeter* " helicopter, of the same stable, receives little attention as it flies alongside.

The sound of turbines is again audible. The *Westland " Wyvern "* torpedo aircraft circles the field, quieter and more manœuvrable than its piston-engined counterpart at Radlett two years ago. After it comes the " *Marathon II* " which, seemingly confident of the power of its two turbines, takes off quickly and very steeply for a commercial transport. Then the " *Apollo*," which looks extremely graceful—far more impressive than when it is on the ground.

Before it has time to land the first jet aircraft of the day—the low-set, blue " *Canberra* "—shoots along the runway, becomes airborne, gains speed and climbs with breathtaking rapidity. Here it is, back again, banking tightly on almost vertical wings, now ascending like a rocket—did we read correctly : " high-altitude medium bomber " ? The impression is rather that of an outsize jet fighter. Or a modern counterpart of the versatile " Mosquito." All three wheels touch down simultaneously as it lands—fast, flat.

There are many reasons for remembering September 8th—one of them being that it was the date of the long anticipated but unexpected first public flight of the world's largest landplane—the eight-engined *Bristol " Brabazon I*," which had tried its wings only four days beforehand. No sooner is it visible over the horizon than its engines begin to drown the noise of the loudspeakers. It seems to approach very slowly, flies low over the spectators, describes a wide curve as it recedes into the distance. Back again from the opposite direction, it exhibits its gigantic but graceful contours, and departs as majestically as it arrived.

This is not the place for discussing the problems and costs of those " biggest " aircraft which, from time to time, have formed the milestones of aviation history but frequently were day-flies : Junkers G 23, Dornier Do X, Douglas B-19, Lockheed " Constitution " and others. Those who saw them for the first time, were always surprised by that " slowness " which underlined the " ceremoniousness " of the occasion. This is because the eye is

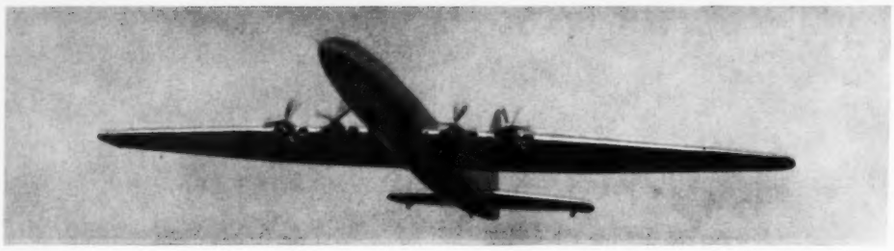
Cierva W.11 " Air Horse " three-rotor helicopter...

... and its baby stablemate, the Cierva W.14 " Skeeter."

Handley Page " Marathon II " feeder transport —two turboprops instead of four piston engines.

Britain's first jet bomber, the twin-jet English Electric " Canberra " put on a surprising display of manœuvrability.

A " Viking " descendant : Vickers " Varsity " training aircraft with nose-wheel undercarriage.



The gigantic Bristol " Brabazon I," awaited with tense anticipation.

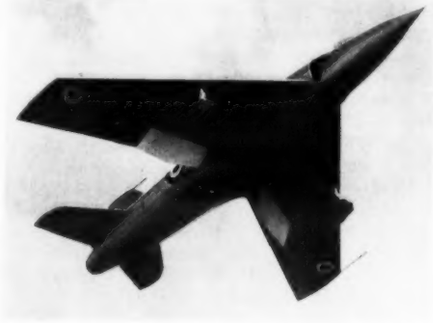
The lines of the de Havilland " Comet " are even more graceful in flight.

used to estimating the speed of an aircraft from its length—a yardstick which fails when this length is extremely great. Another factor is that all these aircraft were underpowered in relation to their size, because engine design did always, and still does—even in the present era of big (?) gas turbines—lag behind the development of big airframes. This also applies to the " Brabazon I " : in place of the eight " Proteus " turboprops which, by the time they are ready for installation in the " Brabazon II," will surely furnish more than 3,500 h.p., the prototype has had to be fitted with Bristol " Centaurus " radials giving little more than 2,500 h.p. Thus the " Brabazon I," even in the unloaded state in which it is being flown at present, has a higher power loading than a normal transport aircraft at maximum all-up weight. But from time to time leading aircraft firms have to risk a construction bordering on the limits of their possibilities, in order to gather experience for eventually smaller tasks. It is like a child which learns to count up to a hundred before it is taught its tables...

Meanwhile, the " Comet " has taxied out to the runway, its four " Ghost " turbojets idling eagerly. All eyes are upon it. In addition to the dexterity with which its pilot, John Cunningham, flies the big airliner low over the crowd, then turning with apparent ease, we all admire the graceful lines of the slender, slightly swept-back wing with its thick roots housing the engines.

Now it is the turn—after fly-pasts at top speed of the none-too-silent " *Hermes* V " and various piston-engined aircraft of all sizes—of the jet fighters.

Lightning climbs upon leaving the ground, power dives, fly-pasts at close to sonic speed, vertical ascents, half rolls, turns, high-speed landings—it all happens too quickly for us to analyse the performance of the individual aircraft. The climbing performance of the " *Meteor 8* " is spectacular after having seen the civil aircraft. The *Vickers 510* and *Hawker 1052* put on impressive shows of speed ; a few seconds later, their swept-back wings vertical as they shoot upwards, they remind one of rockets. The " *Vampire* " and, especially, the " *Meteor* " clearly reveal the climbing advantages offered by afterburning—a round, blue hole burned through a cloud by the " Meteor " causes laughter to break out among the spectators. And after the " *Avon-Meteor,*" which shows in an unforgettable way what extra engine power can do, John Derry ends the day with a brilliant demonstration of the " *Venom* " : perfect response in tight banks and controlled rolls speak for both pilot and aircraft, and cause one to forget that the " Venom " was completed only just before the show.



One of the fastest aircraft of the day, the Vickers Supermarine 510 lowers its flaps to cut down speed for landing.

Hawker 1052 single-seat jet fighter—also single-engined but with an air intake on either side of the fuselage.

De Havilland D.H.112 " Venom," latest development of the " Vampire. "

Silence creeps over the airfield. Tractors tow the aircraft back to the park where the ground crews look to their charges, casting tarpaulins over cockpits and engines.

Night is falling as the green bus brings us back to London.

Did the show give a full picture of Britain's aeronautical production ? Many young people as well as old visitors missed the numerous personal aircraft types which were an interesting feature of previous years. The only firms to put anything in that line on show were *Auster* and *Chrislea*, whose commendable four-seaters received but little attention. Characteristically, they laid emphasis on their designs' utility as military trainers (the demonstration of an Auster showed it to be fully aerobatic), general utility and ambulance aircraft. The sad fact is that private flying at present offers no attractive business possibilities. Only such organisations as defence ministries and, from time to time, airline companies are in a position to place worth-while contracts.

The military types that were demonstrated, showed conclusively that British aircraft constructors have no intention of resting on their laurels. This is something they have never done as far as fighters are concerned ; the development of new engines has never given them time to do so. There was perhaps a greater temptation to stay in the rut—or, better said, on the running belt—along which the bombers reached the R.A.F. and, later, Germany's industrial targets. But Britain's first jet bomber shows that here, too, new ground is being trodden.

With respect to commercial airliners British aircraft designers—the " Comet," " Viscount," " Apollo " and also the " Brabazon " prove it—have endeavoured to surmount their post-war obstacles by " leaving the highway." Courage and skill have made these successful prototypes possible—even the most sceptical observer will not deny that. Nevertheless, prototypes are not the same as production aircraft ready for service. And about that aspect, the S.B.A.C. show does not tell us very much. For success, the next step—after courage and skill—will require precision and endurance. Britain's commercial transport aircraft, correct in conception, must also show their superiority as regards the smallest details of equipment and interior layout. And why should they not do as much ? Courage, skill, precision, endurance—British qualities ! *Vivat sequens*, Farnborough in 1950.

The Coming Crisis in U.S. Aviation

BY CHRIS MICHAELSON

The Editors feel that they must precede the following article with the classic remark about their not necessarily sharing the author's views, simply because they believe that the writer—a highly qualified observer in Washington—is a little over-pessimistic in assessing the present situation of the American aircraft manufacturing and airline industries. His arguments are plausible and instructive, however, and may serve as a warning of where the U. S. aviation industry might find itself one day if it continues along its present course. But there is no indication that it *will* continue along this course.

To American aviation experts the simultaneous appearance in the British Commonwealth of two jet-propelled commercial transports, the Avro-Canada C-102 and the de Havilland D.H. 106 "Comet," has been a godsend, since it gave a degree of justification to their propaganda claims that America was "falling behind" in the development of modern transport aircraft and that the Government should do something about it.

The Editors of this magazine have so far failed to notice any signs of such a state of stagnation. They believe that when the problem of a large-scale change-over to high-speed jet-propelled transports becomes acute, the American air transport industry will be ingenious enough to find the funds necessary to purchase such equipment—thereby providing a ready market for the makers of such aircraft. Even at the present time one or two American airlines are reported to be showing *active* interest in new jet or propeller-turbine transport designs.

Moreover, the entire structure of the airline and the aircraft manufacturing industries may have changed profoundly by the time the problem becomes acute. This summer has shown what a prolonged drought can do—the big trees suffered no appreciable damage, weaker ones and small shoots have died off. Next spring the life of the big ones will be all the easier because the undergrowth no longer hampers their development.

The American aircraft industry is now suffering from a drought of orders. This will necessarily provoke the demise of several smaller enterprises. The bankruptcy of Luscombe Aircraft has just been announced. Luscombe is not the first, and others will follow. The result will be that the present large number of individual aircraft companies will make way for a smaller number of stronger concerns. This will be achieved partly through a number of company consolidations, discussions for which have been going on for some time. Consolidated Vultee last year had merger discussions with Curtiss-Wright, then with Lockheed, Northrop, North American and others. The driving force behind these talks has been Floyd Bostwick Odlum, one of the most imaginative and powerful American industrialists and financiers, President of Atlas Corporation, the investment company, Chairman of Consolidated Vultee Aircraft Corp. and head of other concerns.

The purpose of these amalgamations ? Nothing less than a sort of "General Motors of the aircraft industry." So far, however, the planners have had to go extremely slow, for America's anti-trust legislators have been watching every one of their moves like a dog watches a cat.

Similar trends manifest themselves in the air transport industry. Unlike in aircraft manufacturing, these tendencies in the "operating industry" are officially encouraged by the competent Government authorities, notably by Joseph J. O'Connell, Chairman of the Civil Aeronautics Board. And the "Floyd Odlum" of air transportation is Juan Terry Trippe, President of Pan American Airways, who at this writing is engaged in a battle to acquire control of American Overseas Airlines. He also has applied for permission to operate domestic routes within the U.S.A. ; he has bought substantial parcels of shares in other U.S. (domestic) airlines, and he has made money when most of the other lines were being bled white.

If two or several giant concerns—aircraft manufacturing and operating groups—arose tomorrow, the "coming crisis in U.S. aviation" could probably be averted, and U.S. aviation would still run on a private enterprise basis. In that case, the operators would certainly have the financial means to buy a jet transport from the manufacturers, who would certainly find the funds to develop such a type.

Left : Floyd B. Odlum.
Right : Juan T. Trippe.

Just one more point : Who can assert with any degree of assurance that a jet-powered Convair-Liner is not streaking through the skies of San Diego this very moment, that a jet adaptation of the "Constellation" or an entirely new type is not on the drawing boards at Burbank ? The makers' untraditional lack of propaganda in this case would be governed by strictly commercial considerations—they have no wish to make fools of themselves by premature publicity and in addition spoil the market for their conventional transport models. There are jet airliners also on the American horizon, but the skies will see transports with reciprocating engines for several years to come. American private industry *must* think commercially, for it cannot afford the luxury of a flop in developing a new transport.

And this is one of the fundamental differences between private and nationalized or "nationally financed" industry. Suppose one of the new State-financed jet-propelled transport prototypes proved a resounding flop or crashed tomorrow . . . The country's supply ministry would walk out front in the funeral procession and then go home to write out the cheque to cover the cost. In America, the manufacturer would have to enter a very large figure in his books—in red ink.

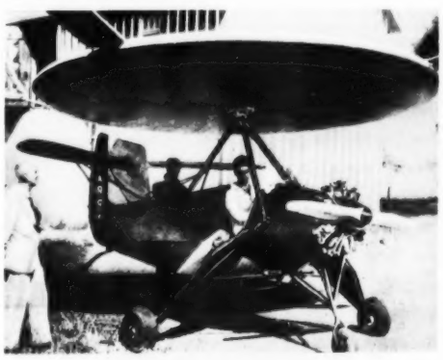
The Editors.

Whether you think they were bicycle mechanics or gifted scientists, the Wright Brothers were the first to fly and that makes the United States the birthplace of aviation. After sagging badly through the first World War, U.S. aviation began to reach its stride in the 'thirties and burst into blinding world leadership during World War II. Today, without bias, that leadership is extant—but on the distant horizon is a dark cloud of doubt and fear that, unchecked, can destroy its great airlines, tremendous aircraft factories, its pioneers and its students. That cloud is economic ruin, the seeds of which have been 30 years agrowing.

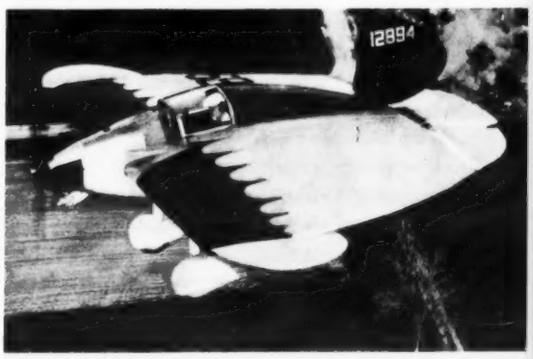
The rumbling and quaking of this crisis was suddenly crystallized by the first flights of the de Havilland "Comet" and the Avro (Canada) C-102 jet transports, which epitomize the economic paralysis creeping now perceptibly over the U.S. aviation scene. That both of these historic aircraft were spawned by a deficit economic system is beside the point —the unparalleled U.S. aviation industry has not only been paralleled but decisively bested at its own game : technical progress.

The failure of the United States aircraft manufacturing industry to produce the first jet airliner represents the first time in its history that economic considerations have stymied engineering progress. For the first time in more than 40 years, the money could not be found to sponsor a new U.S. aircraft design. The history of U.S. aviation contains a priceless sub-history of fantasy and foolishness in aircraft design, for this country has produced a Barnum & Bailey collection of round wings and suction wings, channel

Caldwell Circular Wing.



ARUP Flapjack



The original DC-3 cost $115,000. To convert it into...

... the "Super DC-3" costs $140,000 to $200,000.

wings and flapping wings, steam-powered and diesel-powered ; triplanes and multi-planes, ornithopters and helicopters—the list is endless, but always there was capital for the inventors to produce a prototype in which to break their necks. But not now.

And why ? The reasons are manifold and complex but germane to the problem. First is the fantastic spiral of aircraft design cost. For example, Douglas Aircraft Co. is now offering to refurbish a used DC-3 transport into a new Super DC-3 at a cost varying from $140,000 to $200,000, when the original cost of the brand-new DC-3 was only $115,000. During 1944, when the U.S. aircraft manufacturing industry was in the midst of producing the astonishing total of 96,318 airplanes in a single year, the cost per pound of airframe weight fell to about $5.00. By 1946 this figure had risen to about $30 and is now hovering near the $50 mark, or ten times the wartime figure. This cost is, of course, on a production quantity basis. Experimental costs have risen from a wartime low of about $25 to more than $100 per pound of airframe weight. This means, simply, that to design and build a prototype with an airframe weight of 100,000 lbs. would now cost more than $10,000,000. Experts have estimated that a new multi-jet transport airplane would cost somewhere between $10 and $20 million in the U.S. today.

This rising cost is not attributable to any single factor. Rising labour and material costs are, of course, common throughout the world and particularly notable in the U.S. But the complexity of the machine itself is the major item in this increased cost. Yet the airframe industry does not share in the increasing cost of this complexity, for its role is simply sheet metal fabrication and assembly. Power plants, landing gear, operating equipment and electronic devices are all produced by other industries who skim the profits from this complexity. Boeing Airplane Co., for example, receives only 34.2 percent of the cost of producing the complete B-50 bomber —the rest of the money goes outside the industry.

How much money does the aircraft manufacturing industry have ? In 1939 the total U.S. industry, made up of 21 airframe and aircraft equipment companies, possessed only $66 million in working capital between them. The tremendous expansion of the war period raised this total to nearly $600 million at the close of the war. Yet, by the end of 1948, the latest figure available, this working capital had shrunk to $428 million and was dropping fast. Estimates as low as $200 million are now being made for the end of this year, which reflects near-insolvent conditions for some companies, while others remain in firm positions.

Thus, it would appear that some companies would have been able to accumulate the $10 to $20 million required for the design and construction of a new jet transport. But, assuming such a project were feasible, what are the market prospects ? The unstable financial position of the U.S. airline industry is all too well known to merit repeating here. The postwar financial record of U.S. airlines has been a financial holocaust from which recovery is not yet certain. During 1947 the U.S. scheduled airlines sustained the staggering loss of nearly $22 million dollars. The following year this operating loss was reduced to about $7 million and the first half of 1949 indicates the probability of a slight profit for the year, but the losses of the previous years, together with industry-wide purchases of new equipment, has left the airline industry with a long-term debt of about $173 million. Assuredly, an industry that is $173 million in debt does not constitute a potential customer.

Thus, the inability of the aircraft manufacturing industry to provide the investment for a new jet transport was matched many times over by the gross inability of the airlines to buy such a transport. And thus an impasse that frustrated the engineering talent of the nation and one to which no foreseeable normal solution now appears.

The fundamental goal of free enterprise in the capitalist system is monopoly, which, in the United States, is illegal. From the philosophical view, it is this basic disparity in the American system that, its opponents claim, comprises the seeds of its destruction. While the polemics of this situation are today the subject of world-wide schism, the aircraft industries of the world bear some witness to the argument. The U.S. aviation industry was given its initial impetus towards world leadership by monopoly. For example, at the birth of the great airlines and aircraft companies of the nation, Hamilton Standard propellers were placed on Pratt & Whitney engines, installed on Boeing airplanes, which were flown on United Airlines from United Airports, all of which were owned by one group : United Aircraft Corporation ! Along the southern air routes of the nation, Smith controllable propellers were placed on Lycoming engines, installed in Stinson airplanes and flown on American Airways, all of which were owned by one group : Aviation Corp. The Curtiss-Wright Corp. followed the same pattern.

With these combines, it was possible to collect the profits of the individual units into a common coffer, thus accumulating the necessary working capital to shore up sagging units. But the airmail scandal of the early 'thirties dissolved these virtual monopolies for all time and ended the era of great aviation profits. It was ruled that no group that manufactured aircraft could operate them, and vice-versa, with the result that Boeing Airplane Co. was split off from its United Aircraft parent, United Air Lines became an independent entity, etc. Today, therefore, Boeing must pay the same price for Pratt & Whitney engines as does Douglas or Martin ; United Airlines pays the same price for a Douglas DC-6 as does American, etc. Thus, an American Airlines operating loss cannot be absorbed by anybody but American Airlines ; Convair losses cannot be passed on to Aviation Corp. but only absorbed.

Then how can the U.S. aviation industry exist ? The answer is the same as in France, Great Britain, throughout the world : the Government. By providing upwards of 90 percent of its volume, the U.S. aircraft manufacturing industry is being supported by the U.S. Government. By making good its operating losses in the form of mail and so-called "need" pay, the U.S. airline industry is being supported by the Government. And in the U.S., as in all nations throughout the world, Government support means Government control—and that is Socialism.

But is a nationalized aviation industry the answer ? In the case of France and England the answer is assuredly not ! The situations in the aviation industries of these two great air-minded nations is of careful record with this audience. With these two great examples before the aviation leaders of the United States, certainly the warning and consequences are clear. And yet how close to nationalization is the U.S. aviation industry ?

During the last two sessions of Congress legislation has been introduced which would

provide Government funds for the development of a series of prototype aircraft which would meet the needs of both the commercial airlines and the armed forces. The Brewster-Hinshaw bill failed of passage last year and it appears certain that it will not receive action this year. The arguments in favour of such a system of Government-subsidized new transport design and development are largely those contained above : since nobody has the money, the Government must provide the funds in the national interest. Such an argument appears sound to the casual observer, but neither the industry nor the armed services are active in their support of the measure. Firstly, the armed forces don't need legislation in order to develop new transport aircraft (viz : Douglas C-124 "Liftmaster" Convair C-99, Lockheed R60-1 "Constitution") and they are definitely not interested in a jet transport, one of the types included in the study by the Prototype Evaluation and Development Board. Secondly, the aircraft manufacturing industry has ranged from lukewarm to frigidly cold in its support of the measure since it contains the possibility of one of two companies being selected for the job with the result that all of the others would be forced out of the transport development and production field. Thirdly, U.S. airlines have shown only tacit interest in a jet transport due to its comparatively uneconomic performance. Because of this lack of aviation support the bill has not been pushed. But it has received strong support by Government officials and isolated manufacturers and airlines, and Sen. Owen Brewster (Rep., Maine) is certain to press for its enactment during the next session.

But more serious is a number of studies being made by the National Military Establishment at the request of the Senate Interstate and Foreign Commerce Committee to determine "the military needs which can be met in whole or in part through the aid of civil aviation, first, in peacetime, and second, in wartime." Committee Chairman Sen. Edwin Johson (Dem., Colorado) recently pointed out that "the justification for the Federal Government spending hundreds of millions of dollars in promoting civil aviation has been that it is a vital adjunct of the national defence." By thus laying over U.S. airlines an Air Force framework not only of route-pattern but jurisdiction in peace as well as war, the way is being opened for complete Government authoritarian control of operations, as distinguished from the present quasi-judicial control of the Civil Aeronautics Board.

The last link in this familiar chain of events has always been a national scandal involving irregularities in procurement through political influence. The launching of the Congressional investigation into the Convair B-36 on just such a charge precisely filled this requirement. However, the testimony on this investigation has failed to prove any of the anonymous charges made in the matter and the details of the procurement of the B-36 now appear quite in order.

The solution to the crisis is simple : profitable operation of the manufacturing and airline industries. This would permit a continuation of the competitive system which alone insures technological progress in this field. But profits appear impossible at present and with a deepening impossibility for the future. The manufacturers have all lost heavily in their production of the series of postwar transports. Boeing Airplane Co. now estimates that it will lose $10,500,000 on the Stratocruiser project. Convair has already lost more than $30 million on the Convair-Liner production programme and has provided for a further loss in the current year. Glenn L. Martin has already lost about $34 million on its 2-0-2 programme, and this sum is expected to reach about $40 million when the final bills for modifications and design changes are in. Douglas Aircraft Co. has already written off nearly $15 million on the DC-6 programme. Thus, even with substantial production orders, U.S. manufacturers cannot make a profit on commercial business, and they are forced to turn solely to military business for survival.

The possibility of profits for U.S. airlines is too involved a subject to analysze here due to the inextricably interwoven payments for the carriage of mail and in response to "need" by the Civil Aeronautics Board and the Post Office Department. After these payments are made and an airline reports a profit, the word is meaningless. And if a profit is reported, obviously the mail and "need" payments were excessive and the CAB is compelled to request a rescission. Therefore, despite the record-breaking business now being done by domestic U.S. airlines and the reports of profitable operation for the first half of 1949 it is impossible to determine the simple problem of whether or not U.S. airlines are making money.

By thus becoming integrated painlessly but relentlessly into the U.S. Government, the U.S. aviation industry is being driven or led, whichever you prefer, down the road to nationalization. That the current degree is merely a mild form is symptomatic of the existence of the disease.

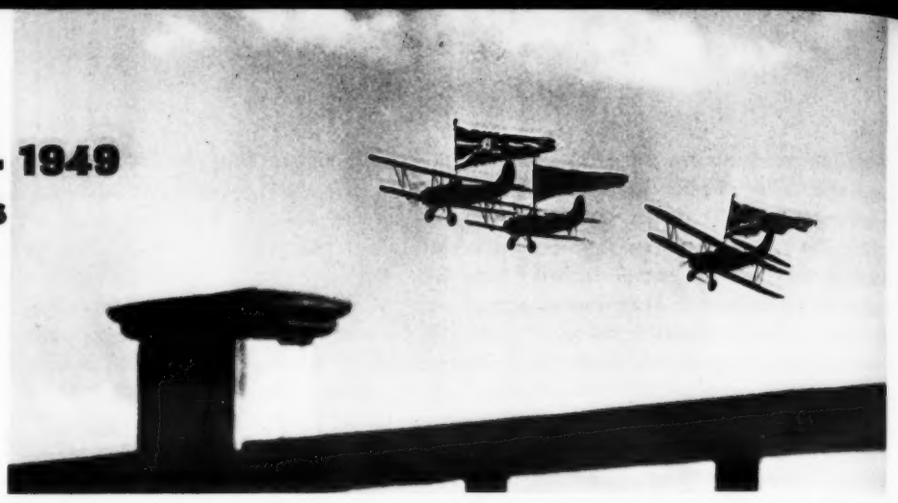
President William A. Allen's Boeing Airplane Co. estimates it lost $10,500,000 on the "Stratocruiser" project.

President LaMotte T. Cohu's Consolidated Vultee Aircraft Corp. has already lost $30,000,000 on the "Convair-Liner" production programme, expects more losses in 1949.

Glenn L. Martin's aircraft company has lost $34,000,000 on its 2-0-2 project, anticipates total loss of $40,000,000.

Douglas Aircraft Co., headed by President Donald W. Douglas, has written off nearly $15,000,000 on the Douglas DC-6 programme.

Soviet Aviation Day - 1949
... and what it means



The 1941 fly-past started with a group of 27 Yak-12 high-wing monoplanes bearing giant flags. Last year there were only three flag-bearing PO-2 biplanes (above)

This year was no exception—the Soviets celebrated their Aviation Day in July. A report written by a qualified observer behind the "Iron Curtain" describes the event in concise form below. The press of the Soviet Union and the "Peoples' Democracies" indulged in interminable stories on the demonstration, but they said nothing beyond the facts enumerated in our Correspondent's report.

What difference is there between Russia's aviation parade and corresponding events in Western Europe, such as the Paris Aircraft Exhibition or the S.B.A.C. Display at Farnborough ? The answer is simple : Western air displays are designed, firstly, to show the country's modern products ; secondly, to impress visitors with these products in order to induce selected customers to do business. Russia, on the other hand, is only vaguely interested in aeronautical business. It is doubtful that she would sell any of her modern jet fighters even to her Satellites, and if an Iron Curtain airline director asked for the price of the Tupolev Tu-70 long-range transport, he probably wouln't even get an answer.

Lieutenant-General Vasili Jouri Stalin, the Marshal's son, organized the Air Force part of the Aviation Day Programme. He is 30 years of age, married to Molotov's daughter.

Russia's aviation parade is designed exclusively to impress. Whom ? First, the vast masses of the population, who thus get an instalment of part two of the classical cry, "Panem et Circenses !" Secondly, any Westerners that were present. Nobody was supposed to see much, however. That probably is the main reason why the latest fighters were flown past at low altitude and "fantastic" speed—very impressive but hardly instructive. —Herewith our Correspondent's report.

"Soviet Aviation Day—1949"

This year's Soviet Aviation Day of July 17th surpassed all previous, similar events in the scope of the preparations and of the actual festivities. Russia's leaders obviously intended the demonstration to be a warning to the outside world that the Soviet Union holds an important position in international aeronautics and that her air force and aircraft industry represent an important factor in the present international situation.

Soviet Aviation Day has been celebrated every year since 1933 on the third Sunday of the month of July. It provides an opportunity to the Soviet Air Force, the aircraft industry and the sporting flying organizations of showing the progress made in the preceding year. The main demonstration takes place at Tushino Airport, Moscow, seat of the Central Aero Club of the U.S.S.R. Similar events are held on a smaller scale in other centres of the Soviet Union, notably in the capitals of the sixteen Soviet Republics, as well as in Leningrad, Gorki, etc.

This year's demonstrations were organized along two lines. On the one hand, the Air Force showed the latest equipment produced by the aircraft industry and demonstrated its newest fighting methods. On the other hand, the people's civil flying organization, DOSAV (which stands for Dobrovolnoie Obstshyestvo Ssodyeistviya Aviazya S.S.S.R., or the All-Union Society of Voluntary Assistance to Aviation), demonstrated the results it has achieved in the training of new members and in popularising aviation in the Union. DOSAV is a civil flying organization mainly in name, since it chiefly engages in pre-military training and has already assumed most of the functions of the former Ossoaviakhim para-military training organization.

The parade began at 12 o'clock at Tushino. Crowds estimated to number 100,000 covered the area from the Moskva River to the sluice gates of the Moskva-Volga Canal. Marshal Vasilevski, the Soviet Defence Minister, issued an Order of the Day congratulating the Air Force and the aircraft industry and ordering a 20-round salute by a hundred guns in Moscow and in the capitals of the Soviet Republics. The guns roared and the great day was on.

The importance which Russia's leaders attached to Aviation Day was illustrated by the large number of top members of the hierarchy who were personally present. The Governmental grandstand was crowded by the following leading Comrades (in the order of the official announcement and, therefore, in the order of their official importance. — Ed.—) : Marshal Joseph V. Stalin, Malenkov, Beria, Marshal Voroshilov, A. I. Mikoyan (Deputy Prime Minister, not the aircraft designer, although the latter's name and initials are identical. — Ed. —), Andreiev, Kaganovich, Shvernik, Marshal Bulganin, Suslov, Ponomarenko, Popov, Shkiryatov, Marshal Vasilevski, Marshal Sokolovski, Air Force Marshal Vershinin, Army General Shtemenko (Chief of General Staff), and Admiral Yumashev.

The fly-past started with a group of 27 aircraft bearing giant flags, either with Stalin's portrait or symbolising the individual Soviet Republics.

What the Air Force showed

Responsible for the organization of the Air Force's contribution to the event was Lieutenant-General Vasili J. Stalin, son of Marshal Joseph Stalin. (Rumours that General Stalin is to succeed his father as the Dictator of the Soviet Union, which have been circulated in some quarters, are denied by well-informed

sources. Young Stalin is described as professional soldier with little interest in politics. —Ed.—)

The Air Force started its display with a programme of solo acrobatics flown by pilot W. Lapshin in a Yakovlev Yak-15 jet fighter. Lapshin is one of the Soviet Air Force's post-war pilots, since he began his flying training only in 1946.

He was followed by a Mikoyan Mig-9 jet fighter flown by V. Kovalev, who put the machine through the entire range of aerobatics.

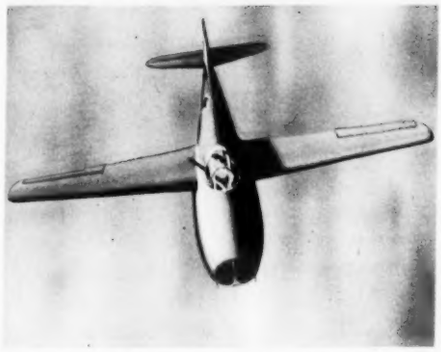
Another programme of solo aerobatics was flown by E. Pepelayev in a Lavochkin single-engined jet-propelled attack bomber (?). Only a few figures were demonstrated, however, notably vertical dives with rapid recoveries and vertical climbs.

Lavochkin La-15 fighters opened the programme of formation flying. First was a flight commanded by Captain A. Babayev which executed extremely tight formation aerobatics, including vertical climbing rolls. Next came a formation of five Mikoyan Mif-9 jet fighters commanded by Colonel Chupikev. Its programme included a number of the most difficult figures, notably a slow roll in formation around the centre aircraft (not too difficult —Ed.). There followed a squadron of nine Yakovlev jet-propelled light bombers (or Ilyushin twin jets ? —Ed.—) commanded by Lieutenant Colonel Shulishenko. The aircraft, apparently of a new type, were shown chiefly in steep dives.

The exhibition of the Air Force's latest fighting tactics started with a duel between fighter-escorted bombers and a number of interceptor fighters. As was to be expected, three bombers were "shot down" and the airfield was fully "protected."

In the bomber class the Tupelev Tu-70 four-engined heavy type arrived over the scene in a very large formation under the command of Major-General S. K. Nabokov, Chief of a Heavy Bomber Division, who was a non-commissioned officer aboard the cruiser "Aurora" in 1918-19. (As is known the Tu-70 bears a suspicious resemblance to the Boeing B-29 "Superfortress" heavy-bomber, three of which fell into Russian hands in July and November, 1944, and were never returned to the Americans. Hitherto the Russians described Tu-70 as a "transport," and such a version does indeed exist. —Ed.—). The demonstration of Soviet Russia's striking might was rounded off by a squadron of Tupolev Tu-2 light bombers and a squadron of Ilyushin 11-10 "Stormovik" attack bombers.

The Air Force part of the show was supplemented by a parachute display initiated by six parachutists jumping from an Ilyushin IL-18 four-engined transport. This jump served to test the strength and direction of the wind for the subsequent mass descent. The interval was filled by three parachutists dropping out of three UT-2 trainers flying on their backs at an altitude of 2,500 ft. and a delayed parachute drop by five civilians. Then began the spectacular mass jump from IL-12 twin-engined transports of hundreds of parachutists, some of whom wore coloured parachutes to produce a striking effect. Remarkable is the fact that all these jumpers are described as "sportsmen," but no doubt this description must not be taken too literally.



Mig-9 twin-jet fighters performed individual and formation aerobatics.

Right : General Alexander S. Yakovlev, of the Air Force Engineering Branch, Wartime Deputy Minister for Aircraft Production, well-known fighter designer. Left : N.B. Rossinsky, reputed Soviet aviation pioneer.

The *clou* of the whole event came in the end in the form of several squadrons equipped with jet fighters and attack aircraft of entirely new designs. Unfortunately, reports from behind the "Iron Curtain" leave the Western European observer guessing as to their types, aspect and performance. The only qualification permitted is that the speeds of these aircraft were "fantastic."

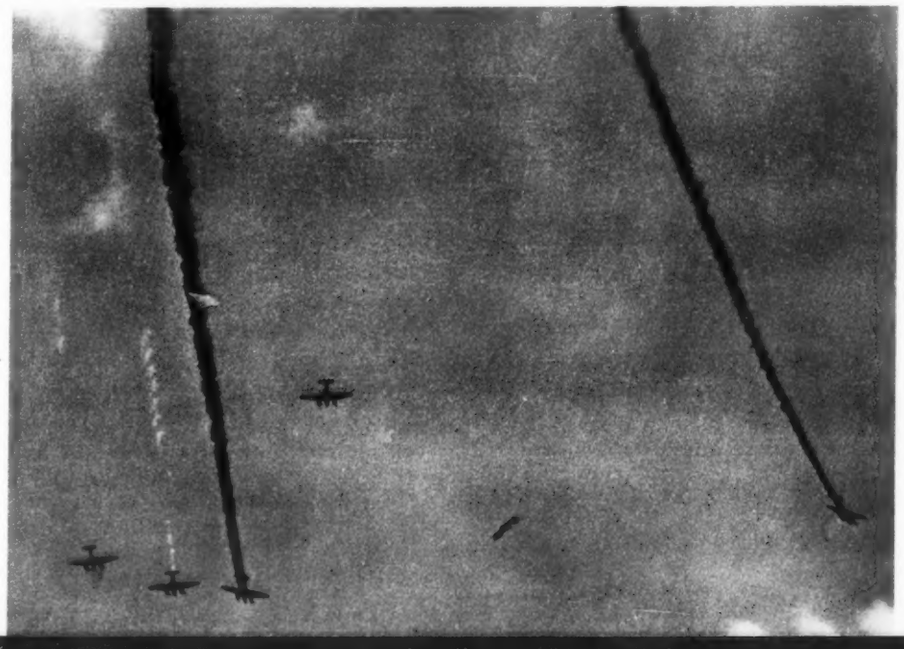
What DOSAV showed

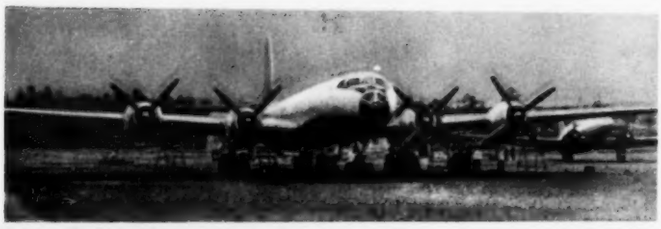
According to the rule that the climax of an event should always come at its end, the Soviet Air Force's show, just described, formed the second part of the official programme for Aviation Day. It was preceded by the less spectacular but nevertheless interesting display of the DOSAV sporting flying association. Responsible for the organization of this part of the programme was Lieutenant General Kamanin, DOSAV's President. Ninety-six Yak-18 two-seater trainers opened the proceedings by flying past the grandstand in a formation spelling out the words "Slava Stalinu" (Long live Stalin !).

The Yak-18 seems to have become the new standard type of Soviet sporting flying. But already it is termed an interim type, pending substantial deliveries of the Yak-20 (with a 600-h.p. ASh-21 engine). The Yak-18 has been released for export ; its price is about $6,000.

Five Yak-18s piloted by women and led by Maria Chechneva, Heroine of the Soviet Union and bearer of ten orders and medals, one of the most successful female war pilots of the Soviet Union, executed formation aerobatics. Another group of 18 aircraft of the same type, piloted by sporting pilots, also demonstrated aerobatics, first in a single formation, then in two formations of seven and seventeen aircraft, respectively.

A duel was staged between fighter-escorted Tu-2 light bombers and "defending" interceptors. The same event took place in 1948 ; here a Mig-9 jet "shoots down" a couple of Tu-2s.





Tupolev Tu-70 bombers seem to be the mainstay of Russia's long-range striking force.

The Yak 18 160-h.p. two-seater is the new standard aircraft of Soviet sporting flying. It can be bought abroad for $6,000.

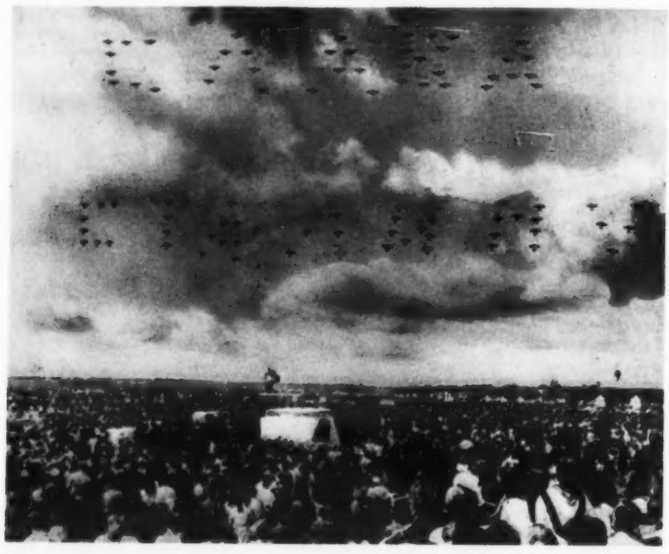
Three sailplanes piloted by women and towed by Po-2 biplanes rose and proceeded to demonstrate engine-less high-precision aerobatics of virtuoso standards. The sporting flying programme of the show was concluded by I. A. Petrov, head of the DOSAV gliding division, who demonstrated the BITch-22 experimental all-wing sailplane designed by Cheranovski.

What Marshal Vershinin had to say

As in every other country of the world, Aviation Day was framed by a variety of auxiliary events, meetings and speeches. A mass gathering was held in the Summer Theatre of the Gorki Park in Moscow on the evening of July 16th. The sponsors were the Moscow Workers' Council, the Moscow City Committee of the Communist Party, and the High Command of the Air Force (Glavnoye Komandovanya Voyenno Vosdushnikh Sil). A static display of aircraft of the Soviet Air Force (but no jets) was simultaneously opened in the Park. Exhibits included a number of historical machines, notably the one which Alexandr Mozhaiski is claimed to have flown in 1882.

Here again the importance of the meeting was emphasized by the rank of the personalities who honoured it with their presence. They included Marshal T. A. Vershinin, Commander-in-Chief of the Soviet Air Force and Deputy Minister of Defence ; Marshal N. D. Yakovlev of the Artillery ; Marshal S. I. Bogdanov of the Armoured Forces ; M. V. Khrunichev, Minister of the Aircraft Industry ; Colonel-General P. F. Zhigarev, Colonel-General S. I. Rudenko, Lieutenant-General V. J. Stalin, Lieutenant-General N. P. Kamanin, all of the Air Force ; and many others.

"Slava Stalinu !" — "Long Live Stalin !"



The main speaker was Marshal Vershinin, Commander-in-Chief of the Soviet Air Force, who passed in review the achievements of Soviet aviation. He reiterated the claim that Alexandr Mozhaiski had successfully inaugurated powered flight about 20 years before the Wright Brothers, and he placed particular emphasis on the pioneering work accomplished by M. V. Lomonossov (the Russian Leonard da Vinci of the 18th centry) and others. However, he pointed out to his 20,000 listeners, an aircraft industry worthy of the name arose in Russia only under the first Five-Year Plan from 1929-1933.

The Marshal then engaged in the now traditional polemics concerning the Second World War. He quoted Stalin's words of November, 1941, according to which the Soviet Air Force had then reached the quality of the German Luftwaffe but was still numerically inferior. The Germans' air attacks on Moscow were more costly than their raids on any other European capital. In 1942 the Germans penetrated as far as the Volga and the Caucasus, owing to the non-existence of a Second Front and through the transfer of their forces from Western Europe. This advance was stopped by the historic battle of Stalingrad, which brought an unpredecented, complete cooperation between the Army and the Air Force.

Left : Lieutenant-General Anton N. Tupolev, of the Air Force Engineering Branch, veteran Soviet aircraft designer ; centre : Major-General Artyom J. Mikoyan, of the Engineering Branch, another of Russia's outstanding designers. Mikoyan is wearing the Soviet Air Force's new uniform.

Vershinin then denounced several "travesties of history." Proof was available, he said, that the Anglo-American Air Forces furnished no decisive contribution to the defeat of Germany. The Americans bombed chiefly industrial installations in which they had no important capital investments, or towns and industrial centres which were on the point of falling into Russian hands. (Russian spokesmen have often claimed that the Americans bombed Breslau, Dresden and other towns shortly before their occupation by the Russians, *i.e.*, at a time when they were doomed anyway.)

He claimed that 75,000 out of the 80,000 aircraft produced in Germany in the last three years of the war operated on the Russian Front. The Soviet Air Force bore the brunt of the battle against the bulk of the Luftwaffe, and Russia therefore also won the air war.

Speaking of the future, Vershinin asserted that the Second World War had confirmed neither the theories of Douhet as regards air warfare, nor those of Fuller regarding armoured land warfare. No single branch of the armed service could decide the issue of any war. World War II, on the other hand, proved Stalin's theory that a war could be won only by complete and harmonious cooperation between the various branches of the services. This, he stated, was the reply to the arguments of the so-called atom strategists. Not even atomic weapons were capable of winning the next war single-handed.

Hundreds of civilian parachutists jumping from Ilyushin IL-12 twin-engined transports. The parachutes, some of them coloured, are of the new square-cut design.

The Russian aircraft industry had made great advances not only in the design and construction of piston-engined types, but chiefly also in the field of jet propulsion. The effective operating radius, the speed, ceiling and useful load-capacity of such aircraft had been increased appreciably. Radar and electronics had been greatly improved, and air missions were now feasible over long distances by day or by night in every kind of weather. New, improved military and civil aircraft were being delivered. These were designed by the following engineers (in the order of their importance) : Tupolev, Mikoyan, Ilyushin, Lavochkin and Yakovlev.

Air Force Marshal Vershinin concluded his exposé by assuring his audience that the Soviet Air Force's reply to the Anglo-American warmongering activities lay in the intensive military and political training of its personnel, improvement of discipline and organization. The Soviet people, he stated, can have full confidence in its air arm.

*

What does this report disclose ? It shows that the Russians possess an air force partly equipped with modern jet fighters, piston-engined fighters, not-so-modern light bombers, and some heavy bombers patterned after yesterday's Boeing B-29 "Superfortress" of the U.S.A.F. It confirms that they are developing new and faster jet fighters, have made a beginning with jet-propelled light bombers.

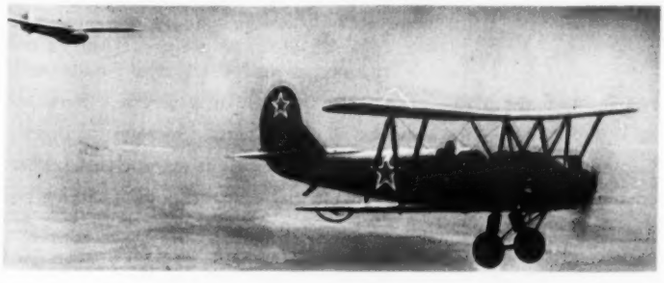
From the operational point of view, it shows that the Soviet Air Force still adheres to the principles it followed—most likely under pressure of wartime events—during the 1941-1945 war : it still is a tactical air arm, with a smattering of strategic bombers in case of necessity. This is borne out also by Marshal Vershinin's heavy emphasis on the necessity of close cooperation between the Services and his quotation of Stalingrad as an example. It is undisclosed, of course, whether this tactical cooperation is intended for defensive or offensive purposes. Equally unknown is whether Russia's long-range heavy bombers are really such a minority. One "very large formation" flying past the grandstand might be the bulk of Russia's heavy bomber forces—or only a fraction. On the whole, however, the impression is gained that Soviet air doctrine—close cooperation with surface forces—still is diametrically opposed to U.S. Air Force thinking, which accentuates the strategic intercontinental bomber.

Industrially, the display was least instructive. It revealed merely that within five years from the "capture" of three undamaged "prototypes" from the Americans, the Soviet aircraft industry has succeeded in putting a modified B-29 bomber and transport into production ; that it is continuing to produce the Mikoyan Mig-9 and Yak-15 jet fighters, that it is about to put the new Lavochkin La 15 jet into production. Last but not least, that the Ilyushin IL-12 and IL-18 twin-engined civil transports are rolling off the assembly lines and are available—for parachute training, as well as for other duties. Furthermore, Aviation Day again purported to demonstrate that thousands of young Russian civilians consider it the most thrilling pastime to climb into civilian aircraft and jump out of them as civilian parachutists. A substitution of "military" for the adjective "civilian" would probably falsify the report only partly.

Finally, sporting flying also has come into its own in Russia. No aero-clubs are going broke because of lacking Government support, as in England and the U.S.A. Yak-18 trainers with 160-h.p. engines are plentiful. Soon the Yak-20 (with a 600-h.p. engine) will follow in quantity. Though why anyone wants 600 horsepower to instruct thousands of young people in peaceful cross-country flying is a mystery.

Not disclosed by the display is the state of development reached by the Soviet aircraft industry, for it is difficult to judge the quality of any aeroplane flying past at high speed. As regards production, however, one is safe in assuming that the industry of the U.S.S.R. possesses the capacity to turn out aircraft in large numbers, just as it did during the war years—not very refined or highly bred, perhaps, but fully capable of doing the specific jobs for which they are designed. An attempt will be made in another article to answer the question of type and performance of new Soviet aircraft models as well as of the state of Soviet aviation in general.

Yemelianov E-8 sailplane towed by a veteran Po-2 biplane trainer.



A new type of Soviet sailplane (left), piloted by a woman. Right : an E-8 two-seater.

Rides, Riots and Roasts... by Radar

The whole thing was a ghastly mistake from the start. When *Interavia* wrote me, "Dear Sir : We would be honoured to publish an article by you on radar and its ramifications," I suspected as much. My name was on the envelope, but . . . still, the funny part would be if Professor Einstein actually sent in a humorous article.

There's no telling ; for, as you will see presently, almost anything can happen when radar's in the air . . . to such an extent, in fact, that I immediately decided to accept the assignment.

I began by recapitulating my own knowledge on radar. As everybody knows, it is used for guiding things. It already guides planes and ships so well that stalwart captains see themselves being gradually divested of their erstwhile glory ; it guides explosive missiles so as to make them fall exactly on X-marks-the-spot or—this is definitely preferable—makes them explode in the air before they fall.

None of these impressive feats being up my street, I made the rounds of the inventors. They were not so fruitful either ; except for one, perhaps, who is endeavouring to use the radar echo principle for what he calls a "Radaminder"—a gadget which reminds you of things at the right time and place. You just put into the gadget the item you wish to be reminded of, say, two days hence at 3 p.m. in another town, tune it in accordingly, press the transmission button, and back (you hope !) comes the message at the right place and time.

No, I discovered that radar can do far more. It can :

safely navigate a boat along the Seine, from the Pont Alexandre III to Suresnes ;

smash to smithereens, from California via the moon, window panes in Naples ;

cook a complete dinner in 3 minutes 45 seconds.

Here, I felt, I was getting somewhere. And as for the accurary of this information, I read it in the Paris newspapers, so there's no doubt about it at all . . .

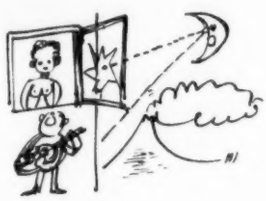
The first item tells of a trip along the Seine in a minesweeper which the French Navy had sent to Paris precisely for sweeping the Seine clean of mines. With the help of radar alone, the captain, buried in a windowless hold, succeeded in travelling about three miles along the river, from the heart of Paris to Suresnes, without so much as disturbing any of the fishermen, washerwomen, dog-clippers and so forth, who eternally litter the banks of the Seine.

Of course, I ought to tell you that the trip along the river from Paris to Suresnes is an institution among Parisians. So well known is that stretch that we have a saying : "Any Parisian can do it blindfold." Which is precisely what the captain of the radar-guided boat did—though in an unnecessarily complicated manner.

The second item, you will agree, concerned a minor tragedy. On a delightful summer evening at Bradley Beach military base in New Jersey, some of the specialists could think of nothing better to do than to try contacting the moon by radar. (Incidentally, matters might have turned out worse had they fooled around with Mars.)

Well, contact was indeed established, but at the same time a small earthquake arose, breaking lots of window panes in—Naples !

How the matter was settled legally, I don't know. Somebody was evidently to blame, but if it was the moon, then there was little likelihood of the good Neapolitans getting new window panes paid for them. Nor do I see, right now, any particularly useful purpose to which such stunts might be put.

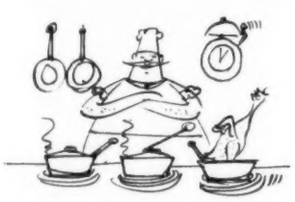


The third event occurred in Boston's Hotel Statler, where engineers of the Raytheon Manufacturing Company decided to prove that radar can cook dishes as rapidly as customers read them off the menu card.

Under these conditions a lobster was cooked in 2 minutes 15 seconds, a sirloin in 50 seconds, potatoes in 20 seconds, ham in 60 seconds, corn in 50 seconds and apples in 10 seconds.

Whilst I have no great sympathy for military engineers who devise radar-guided bombs and so forth, I can't say, either, that my heart warms to Raytheon's engineers.

Granted—potatoes, corn and apples don't deserve more than a few seconds of cooking ; but it's going too far when it comes to lobster, sirloin and ham—dishes really worth a little more respect.



For example, a minister visiting an art gallery could quite easily run through the place—even pedal through on a bicycle. However, he is expected to show, and be shown, a certain measure of dignity. Please excuse my comparison, but I feel that lobster, surloin and ham are, in a way, of ministerial rank in the domain of gastronomy, and therefore should be treated accordingly.

Still, there's no denying that the radar-cooking process offers a good measure of utility. Many a housewife, for example, would be glad to possess a radar cooking range such as that of the Hotel Statler's chef. Less work, no meals served late . . . But let us not fall into the trap of thinking that radar could thus be used to eliminate quarrels between husbands and wives. Science has certainly not got that far yet ; and the only technicians able to boast of having made any sort of contribution to domestic bliss, are not the radar people but the manufacturers of unbreakable pottery.

Yves Grosrichard.

Three Men in a 'Plane... not to mention Mr. Schreiber

The Story of the First French Atlantic Flight

BY RENÉ LEFÈVRE, PARIS

Forty years have passed since Blériot flew across the English Channel and ten years since Pan American Airways' "Yankee Clipper" started a scheduled air service across the North Atlantic between New York and Lisbon—between the New World and the Old World. As though it were yesterday!

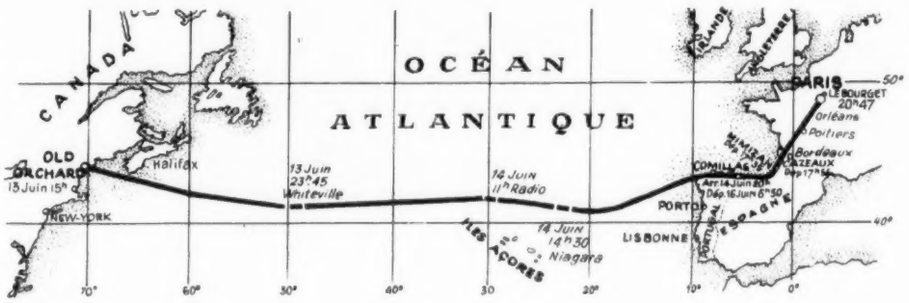
Progress has been meteoric; regular Atlantic crossings by air are now an accepted part of our daily lives. Many still remember names such as Lindbergh, Chamberlin, Balbo. But who today speaks of a single-engined aircraft called the "Oiseau Canari"—the Yellow Bird, with which three young Frenchmen flew from New York to Europe in 1929?

And yet, those three Frenchmen, Lefèvre, Assollant and Lotti, count among the real air pioneers of the Atlantic, for only seven aviators had previously made successful west-to-east crossings.

It was twenty years ago.—But let us not further delay René Lefèvre, who planned and participated in this flight. He must tell his enthralling story himself. In those days he was a young lieutenant in the French Air Force. Later, he entered the management of the Air Afrique air transport company, and after the last war he organised Air France's service to the West Indies.

On June 14th, 1929, the radio and the press announced that a French aircraft, the "Oiseau Canari," had taken off from America, bound for Paris, and had landed safely near Santander, Spain, after a nonstop flight of twenty-nine hours, *with a stowaway on board!*

Here is the story.



The crew

All three of us—Assollant, Lotti and I—were young. In 1928, the year our plans started to take shape, Lotti was thirty, Assollant twenty-three and I was twenty-four.

Assollant and myself had been trained by two famed French aviators, Commandant Weiss and Capitaine René de Vitrolles. Despite our youth, we felt sure we were sufficiently experienced to risk such a tough undertaking for those days—an Atlantic crossing by air. But the way in which our cherished ambition passed from the dream stage into reality was most unexpected. During a banquet Assollant spoke about our idea to his neighbour at the table. You may imagine his surprise, and joy, when a few days later he received a 'phone call saying that a certain young man, who had some money, was keenly interested in the idea. Assollant arranged to meet him. His name was Lotti, and his parents owned a hotel in Paris. It was not long before he was as enthusiastic about it as we were. Since he was paying 200,000 francs towards what was now a project, he wanted to take part in the flight. This was easier said than done, for his parents had no desire that their son should share in such a hazardous adventure. Thus, if he was to fly with us, he had to do it clandestinely.—The romantic story of our flight was beginning to unfold.

By the way, Lotti's financial contribution was not sufficient to cover the entire costs of the attempt. Assollant's parents had to come to the rescue, by mortgaging their house for 100,000 francs.

The aircraft

With the financial problem more or less solved, it remained for us to look around for a suitable aircraft. In those days aircraft capable of spanning the Atlantic nonstop were extremely rare. Lotti had the good fortune to stumble on a designer who had three-quarters completed a monoplane destined for an attack on the distance record. It was a wooden aircraft, powered by a 600-horse-power liquid-cooled engine, and originally designed for carrying eight passengers. But it could be transformed so as to carry about 1,000 gallons of fuel. Its cruising speed of 120 m.p.h. and top speed of 150 m.p.h. made it one of the fastest commercial aircraft of its day. It was capable of staying on the wing for forty-two hours and covering 5,000 miles without re-fuelling. As the shortest distance between France and the U.S.A. amounted to about 3,000 miles, we had enough margin for safely overcoming any headwinds that might prevail.

The firm of Bernard Co. let us have this aircraft, without engine, for 300,000 francs—200,000 on the nail and the remaining 100,000 after successful conclusion of the flight. But the Société Hispano-Suiza made us a gift of two engines and furthermore placed its engineers and mechanics at our disposal. This generous aid was a precious contribution towards the success of our undertaking, and we appreciated it all the more as the government—which usually subsidised such flights substantially—gave us no help at all.

Before crossing the Atlantic (left to right): René Lefèvre, Jean Assollant, Armento Lotti.

An official who scorned red tape

In place of help the government placed obstacles in our path. After a first attempt which failed—ending in Casablanca—our military superiors, influenced by the critical remarks in the press, ordered Assollant and myself to return from Casablanca immediately to our military base at Le Bourget—not giving us enough time even to repair our aircraft. Then, we were formally forbidden to undertake any record flight at all. Since there was no way of taking off from French soil, we had to change our plans and consider a flight in the other direction, thus from the U.S.A. to France.

This meant shipping our aircraft to New York. As Lotti's funds were running low, we had no choice but to approach his parents, whose acquaintance we had just made. They agreed to help us again, but still on the condition that their son would not take part in the flight.

Meanwhile, there were many other problems still to be solved, such as acquiring the necessary documents and choosing a port for embarking, for instance. Our aircraft was not registered with the French Air Ministry, so that no documents were forthcoming. Again and again we approached the airworthiness commission, but they demanded the impossible of us. For example, they ordered us to install position lamps. Imagine what useful purpose they could have served over the Atlantic—a

The "Oiseau Canari" at Roosevelt Field, near New York.

desert sky in those days—and especially as we were trying to cut down weight to a strict minimum. There was no doubt that the authorities were bent on making matters as difficult as possible for us.

Negotiations with French shipping companies were equally fruitless. In the end we discovered that the only way of transporting our aircraft to the U.S.A. was in an American ship... which did not stop in France but only in England. That meant flying to England, and as we had no papers we risked having our machine seized by the British authorities.

The British Air Attaché in Paris advised us, confidentially, to risk the flight all the same, and to try "wangling" matters once we were on English soil—though under the condition that, if the British nevertheless created difficulties, we should not mention his name.

Assollant and I took off for England in the "Oiseau Canari" early in the morning of April 19th, 1929. As a matter of fact, we got away by the skin of our teeth. Upon our arrival at Orly, the airport manager received us with an ironic smile: what in Heaven's name were we doing at the airport so early in the morning? With an expression as innocent as we could muster, we explained that we wanted to test our radio equipment. To our great surprise, he informed us in no uncertain tones that "we could tell that to the marines!" and that he knew quite well we were going to England. Taking advantage of our dismay, he triumphantly brandished the morning newspaper before our faces—disclosing our plans in black on white! It happened that, on the previous evening, we had dined with a journalist friend of ours. Apparently his friendship for us had not gone beyond the bounds of his professional zeal. Well, there was nothing else we could do but admit the news was true. But at this moment we discovered that there lived at least one official whose heart was not of stone. He actually agreed to our suggestion that he shut his eyes to our departure; after all, he was not expected to call the police to prevent our take-off, as "trial flights around the field" were perfectly legal; and in any case the weather forecast was not favourable for a flight to England. He told us he'd give us an hour's start before reporting our "crime" to the Air Ministry.

Moving from Roosevelt Field to Old Orchard Beach.

Two hours later we landed on the Avro factory airfield at Southampton. Lotti was there to greet us. With the help of British mechanics we immediately began dismantling our aircraft, as the departure by ship was set for the following day.

Old Orchard Beach

Upon arrival in the U.S.A. I assembled the "Oiseau Canari"—"Yellow Bird" as the Americans called it—and wired Assollant and Lotti that everything was ready. Roosevelt Field, where we carried out the final check flights, was too small for taking off with the machine fully loaded. Before leaving France we had expected to find an impressively long, wide runway. As a matter of fact, such a runway had been constructed specially for Byrd, but it has since been neglected and nothing remained when we arrived.

Finally, we discovered a suitable strip of sand in the State of Maine, 300-odd miles northeast of New York. But there was no hangar, in fact no form of shelter for our aircraft. This was not exactly the best thing for a wooden aircraft, to be exposed to the rain, brine-laden air, and sun while we were waiting for suitable weather. Nevertheless, it struck us as being wiser than to risk an abortive take-off at Roosevelt Field.

Every day the New York Weather Bureau cabled us its forecast. You might be surprised to learn that we had to pay the costs of the telegrams to a private company, which received the weather reports from ships out at sea. In those days there was no such thing as an international weather service; and it was a matter of luck whether the forecasts turned out to be accurate.

After several day's waiting we finally received news of acceptable weather conditions. All the same, we judged it wiser to deviate somewhat to the south, as we might otherwise encounter the southern edge of a fairly strong depression.

Our take-off was fixed for June 13th and we started filling our tanks in advance. As the wind conditions were favourable, we filled up with a hundred gallons less than normally, in order to render the take-off safer. And so that the tail skid would lift up easier, we placed all the loose goods, such as warm clothes, pocket lamps, food, maps, and so forth in the nose of the aircraft.

Sand, sweat and... stowaway!

After a night of anything but rest, we stood at eight o'clock in the morning before our "Oiseau Canari."

Perhaps the best way to describe the circumstances in which our take-off was effected, would be to give you an idea of the terrain.

The runway consisted of a strip of sandy beach, about a mile and a half long, which provided a reasonably hard surface when the tide was out. At the southern extremity of the beach there was a stone breakwater, about fifty feet high and extending for quite some

Puzzle! Where's the stowaway?

distance into the sea. On our left was the ocean, on our right an uninterrupted row of houses. Thus, as soon as we were airborne, we would have to bank to the left, towards the sea, where there was no obstacle to prevent our heavily-loaded aircraft from gaining altitude slowly.

Thousands of people, informed by the radio, had turned out to watch our departure—and also that of an American aircraft which, we learned later, crashed during the take-off.

Our first job was to move the aircraft as far away from the breakwater as possible, in order to improve our chances of clearing it when we took off. So as not to tire the engine unnecessarily, we appealed to the spectators, who were only too glad to lend a hand at towing our machine. A cable was fastened to the undercarriage and, with about a hundred people pulling, the aircraft was easily displaced to the take-off point. In order to prevent the wheels from sinking too deeply into the sand, we put down wooden planks for the first twenty yards. Contrary to what one might have expected, there were not many policemen for holding back the crowd—just a few on motorcycles. But whilst it was unpleasant to realise that anybody could steal up to our aircraft and carve his initials on it, we couldn't very well send away people who had so willingly helped us tow the machine. Finally, we had to ask them to clear the runway.

While the engines were warming up, we were besieged by reporters and cameramen. You will realise that we had little interest in having ourselves immortalised on celluloid at a moment when we were risking our lives.

After this long exchange of courtesies we finally stepped into the aircraft—Assollant and myself at the dual controls, Lotti in the navigator's quarters at the rear, connected with the cockpit by a narrow corridor between the huge fuel tanks. Our U.S. mechanic shook hands with us, bidding us a hearty farewell, and shut the cockpit door.

It was ten o'clock. The tide was out and a sufficiently large strip of beach lay before us. A last engine check : everything in order. The chocks were pulled away from the wheels. Assollant opened the throttle gently, then pressed with both hands on the stick. To keep the engine at full speed I pulled hard on the throttle, keeping my eyes glued to the tachometer. The machine taxied forward, at first slowly, then faster. But the tail skid seemed to be riveted to the ground. What was the matter ? We knew every little idiosyncrasy of the "Oiseau Canari." It ought to have risen long ago. The distance separating us from the stone breakwater was diminishing at an alarming rate. But we still persevered. Finally the fuselage became horizontal, but the machine still felt "too heavy" for Assollant to pull back the stick and take her into the air. The distance was becoming ever smaller ; only two hundred yards separated us now : we had to take off at all costs. Assollant veered

EXTRA! EXTRA! EXTRA!
Boston Traveler
FRENCHMEN HOP OFF
FORCED TO COME BACK
YELLOW BIRD IS BACK 20 MINUTES AFTER TAKE OFF

A special issue of the *Boston Traveler* "whitewashes" the first abortive departure for an Atlantic flight.

towards the ocean ; towards that other obstacle limiting our take-off run and which we had to clear within a few seconds—or else...

In a last, desperate attempt, Assollant dragged the aircraft into the air, just missing a breaker on the beach. It was slow to respond, climbing inch by inch, the tail hanging dangerously. We were skimming the waves. The slightest drop in r.p.m. would have dropped us into the water, bringing our aventure to an unpleasantly sudden end.

For ten minutes, which seemed like years, we stayed with the tail down, gaining but a few feet altitude. The sea, which we dared not contemplate, was rushing beneath our wings.

We didn't know what to think. We dared not communicate our impressions to one another. Had we so much as looked at each other, the aircraft would surely have crashed.

In the navigation cabin, Lotti had his hands on the fuel cocks, ready at my signal to dump the entire load. But a few days beforehand already, we had to jettison about 800 gallons during a preliminary test, and friends in France had cabled us that we should avoid any further abortive departures, as the Air Ministry had already expressed to the press its displeasure over our attempt.

Then suddenly, as though by a miracle, the aircraft suddenly righted itself and began to climb. Above the noise of the engine I heard Lotti calling me. I turned round, happy to tell him we were at last safe. But imagine my surprise when I saw, along the passage between the fuel tanks, two faces instead of

"Constellations" now carry you regularly between the U.S.A. and Europe. Frankly, would you like to risk a crossing in the old "Oiseau Canari," with only one engine?

one—Lotti and an individual I had never seen before. A stowaway ! A almost exploded with rage, but I had to control myself and accept the presence of this intruder. All I could do was to order him to come forward into the cockpit, in order to rectify the equilibrium he had imperilled.

This blockhead, taking advantage of a moment when our attention was claimed by the newsmen, had simply slipped into the aircraft and hidden in a sort of locker in the fuselage tail—in a spot where we wouldn't have stowed one superfluous ounce for fear of unbalancing the aircraft.

His name was Schreiber. He had just thought that it would be fun to make a pioneer Atlantic air crossing as a stowaway.

Pros and cons of a stowaway

With Schreiber in the nose instead of the tail, our aircraft gained about three hundred feet in a few minutes. The engine was turning smoothly. Happy to have avoided a catastrophe, and as everything seemed to be in order, we decided to continue the trip.

Lotti, businessman to his finger-tips, considered Schreiber's presence from the commercial standpoint. He had no doubt that we would succeed and was determined that Schreiber should not be the sole beneficiary of any profits he might be able to accrue from his adventure. Consequently, he drew up a contract—very short—by which Schreiber agreed to hand over to us fifty per cent. of anything he might later earn from our exploit. Lotti maintained that the contract had to be signed in ink if it was to be legally in order. As no one possessed a pen, Lotti used the ink from the barograph. In that way it can be said that the "Oiseau Canari" accomplished the first commercial air crossing of the North Atlantic.

We have often been asked why we didn't throw Schreiber overboard.

You are now acquainted with the difficulties and anguish we experienced in trying to gain altitude during the departure. Were we now going to lose it again by fighting with Schreiber ? We were really too happy to have emerged from such a sitation, to dream for a minute of such an extremity ; and I don't suppose Mr. Schreiber would have taken the door of his own accord, politely as we might have asked him : "Please, Mr. Schreiber. Stowaways first !" No, we just decided to hold on to him like some unaddressed parcel.

Incidentally, we enjoyed a certain measure of revenge later on. During the night we encountered some pretty gusty weather—and Schreiber definitely didn't like it. It gave us some satisfaction to see him kneeling with his arms around Lotti's knees, asking in an anguished voice whether this was not the last moment.

But we, too, passed a number of highly uncomfortable hours. I don't think it would be possible to convey an accurate picture of all

After landing near Comillas, Spain.

"...have served French aeronautics..." Lefèvre, Assollant and Lotti are made Knights of the Legion of Honour.

the thoughts that ran through our minds during those twenty-nine hours over the Atlantic.

The long trail home

Our second "thrill" occurred at about six hundred miles off the U.S. coast, when the engine started to lose r.p.m. and the propeller threatened to stop.

Although we knew what the cause was, I can assure you that we were well and truly scared. The thousand gallons of fuel had been divided among six tanks. Each contained a different mixture of gasoline and benzene, which had to be fed to the engines according to a preset plan. But our stowaway, by overloading the aircraft, had compelled us to maintain a higher r.p.m. rate than planned, so that the tanks had been emptying faster—to such an extent that the engine was on the point of stopping.

Lotti and I rushed to the tanks and started opening all the valves without discrimination. The engine came to life again ; but I'm sure it cost us a few moments of our lives.

The night was particularly harassing. During six long hours, unable to see a thing through the blackness outside, we had to contend with thick fog and violent storms which we were unable to avoid.

In this connection I must express my admiration of Jean Assollant who, without giving a sign of tiredness, without losing hope, and with absolute calmness, remained alone at the controls during that six-hour battle with the frenzied elements. As our instrumentation was extremely primitive, Assollant was sometimes obliged, when gusts put the machine out of balance, to cut the throttle and allow the aircraft to recover its stability by itself. Each manœuvre like this caused us to lose hundreds of feet altitude, which had to be regained foot by foot, to put as much distance as possible between us and the raging sea below, threatening to drag us down.

There was one small incident I shall not forget so easily. The blackness outside was so intense, we couldn't see our wing tips. I was at the rear of the aircraft, in the navigation cabin at the radio, in order to give Assollant more freedom in his difficult task. At one moment—I don't know exactly why—I put my hand through the window, withdrew it a little moist, and without thinking touched it to my lips. It was salty ! The horrible idea occurred to me, that we were flying so low, so near to the surface of the ocean, that the waves were spraying up to the cabin window. Trembling with fright, I flashed my lamp on to the altimeter. Five thousand feet ! The salty taste on my hand was from my own perspiration.

In view of the weather, and the rapidly disappearing fuel supply owing to Schreiber's unwanted presence, we decided to head for Cape Finisterre, Spain, thus choosing the shortest route to Europe and simultaneously leading us towards better weather.

Back in the navigation cabin Lotti looked very pleased with himself. But beatitude was written all over Schreiber's face. And no wonder ! In order to restore his faculties after his nocturnal emotions, he had drunk three-quarters of a bottle of old brandy which a well-wisher, a guest at Lotti's parents' hotel in Paris, had given us before we left. In those days there was prohibition in America—and Schreiber had really appreciated it.

After a few hours at the controls, to give Assollant some well-earned rest, I returned to the navigator's quarters. My calculations said we should reach the Spanish coast by 6 p.m. local time. Our eyes started searching the horizon and many were the times we thought to have seen land ahead, only for it to be an illusion caused by cloud banks blocking the horizon.

Mission accomplished

It was 5 p.m., and unless I had made a mistake in my navigation, we were to reach the Spanish coast within an hour. Assollant was the first to sight land—at 5.20 p.m. ; and twenty minutes later it was beneath us. We had taken 26 hours 40 minutes to cover 3,300 miles, the longest distance flown over water up to that day. There is no need to tell you how we felt about it. The earth below had the effect upon us a last-minute pardon must have on a man condemned to death. Plans for the future flashed through our minds.

Why not be frank about it ? A feeling of grim satisfaction pervaded our joy : our revenge on those who prophesied our failure—all of whom, by the way, professed to be our "best friends" when we did finally arrive home.

The Spanish territory below was perfectly familiar to us. We chose a north-easterly heading, in order to follow the coast up to Biarritz.

Although the ground 500 feet below us seemed unsafe for an emergency landing, we felt saved by the presence of civilisation, greeting us with the smoke from a locomotive, the headlamps of an automobile.

But we had to resist allowing ourselves to be blinded by our triumph. It was still a case of keeping cool. When we reached the Spanish coast our tanks held 100 gallons of fuel ; and we had been flying for two hours since. There was certainly not enough for reaching Paris. There was a strong possibility of the engine's stopping when the contents sank to 50 gallons. This meant risking an emergency landing which could compromise our return to Paris.

For a time we hoped to reach Biarritz, at least. But night was falling and the contours of the terrain were becoming increasingly vague. Biarritz had no lighting equipment for night landings.

We decided to land at the first favourable opportunity.

Soon we reached a stretch of sand which seemed more or less suitable. After "once round the field" Assollant made a perfect landing on the sand. We were at Comillas, 120 miles from the French frontier, having flown nonstop for 29 hours, covering 3,600 miles. There were 70 gallons left in the tanks, enough for another 350 miles.

The reception given us two days later in Paris richly compensated our labours and dangers. The newspapers were wildly enthusiastic about our exploit—and that of our stowaway. But the award we appreciated most was the Legion of Honour, citing our "Service to French aeronautics."

A month later we were commissioned by the Government to tour the European capitals with the "Oiseau Canari" (which the Air Ministry bought from us, reimbursing all our expenses)—this time with official French papers, which the authorities had finally consented to accord us.

Was Douhet Right?

General Giulio Douhet, dead and buried for two decades, was the first to advance the theory of total war in the air. Was he right? The newest plans for U.S. defence, giving priority to the B-36 long-range bomber, tend to answer in the affirmative.

The daily and trade press currently publishes articles by numerous amateur strategists who try to teach the public the fundamentals of a theory about which they themselves understand but little, and over which even the professionals are still puzzling.

The present article? In our opinion it has a dual advantage: it originates from the pen of a professional, a non-American who has had opportunity to gather both theoretical and practical experience and who—though he chooses to remain anonymous—must be regarded as an objective observer.—Ed.

Can we evoke the spirit of Giulio Douhet, the Italian general and military writer buried with military honours twenty years ago. During the 'Twenties we were greatly aroused by his "mastery of the air" theory and were either of the party for or of that against Douhet. As far as the young generation of World War II flyers was concerned, Douhet was scarcely more than a name, drowned beneath the din of war. And yet his theory is every bit as topical today as it was thirty years ago. It forms the background to the recent happenings in the U.S. Congress, after Defence Secretary Louis A. Johnson had cancelled the $188 million appropriations for the U.S. Navy's projected Super Carrier and channelled this money into the coffers of the U.S. Air Force. In protest, Navy Secretary Sullivan resigned his post.

Briefly, the question is: which section of the armed forces decides the outcome of a war—Air Force, Navy, or Army? In Douhet's opinion the highly-industrialised countries with their densely populated cities had become so vulnerable that the destruction of their power installations, supply organisations, transport systems, manufacturing and residential centres would inevitably cripple the entire organism and result in capitulation. The heavy bomber, he maintained, was an instrument of destruction able on the one hand to carry out its mission far behind the enemy lines and, on the other hand, thanks to its speed and armament, was immune to enemy action with fighters and anti-aircraft artillery. Thus the aim should be to create an air force so mighty that it could seize the mastery of the air over the enemy's territory. The outcome would no longer be decided, as in earlier wars, on land or sea, but in the air. But, because national defence planning is invariably subject to economic limitations, army and air force armament would have to be ruthlessly restricted in favour of an independent air force. Furthermore, Douhet opined, it would be erroneous to establish strong "auxiliary air forces" for directly supporting the army and navy, as these two services, in a future conflict, would conduct only defensive manœuvres, whilst the decisive, main offensive would be carried out by the independent air force.

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Nine years after Douhet's death World War II broke out, and we might well have

Giulio Douhet, Italian General of World War I, founded the theory of total war in the air.

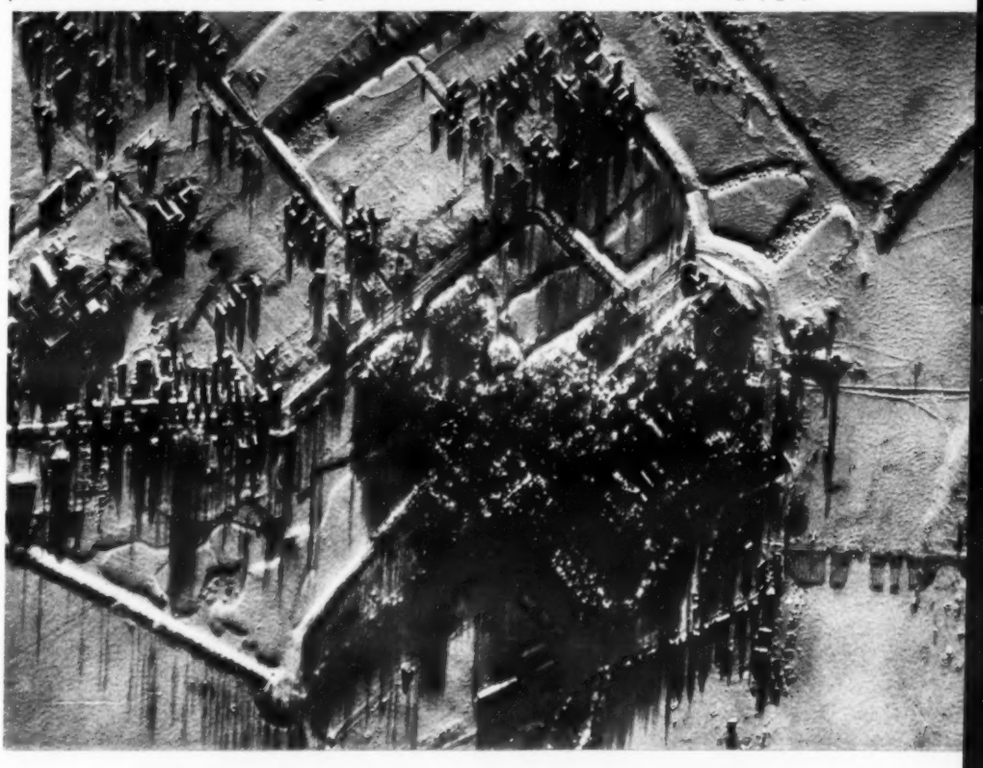
expected this "test case" to yield a clear and unambiguous answer as to whether Douhet's thinking was right or wrong. But it was not the first time that history poked fun at the "either—or" of human logic—cloaking itself in oracular ambiguities and getting away with half-solutions and contradictions.

Was it the bombing attacks that finally secured the Allied victories over Germany and Japan in 1945? That is the question. If the answer is yes, then Douhet was right. Or did all three armed services contribute equally towards the decision? This question gives rise to differences of opinion.

When we review the phases of World War II in chronological order, there is no doubt that the German victories in the Polish and French compaigns were due equally as much to the new tank divisions as to the air force, which worked in close tactical co-operation with the army. Neither in Poland nor in France were the Luftwaffe bombers' targets the enemy "power installations" in the Douhet sense, but airfields, artillery positions, bases, supply lines, etc.

The German air offensive against England at the end of Summer, 1940, was directed against the Britons' nerves, the specific aim being to break the British will to fight by destroying the sea ports, key industries, and by wearing down the population. True, this was the first trial application of the Douhet theory, for the army and navy indeed sat on their haunches whilst the Luftwaffe pounded England day and night. But the organisers of this trial disregarded two of Douhet's prere-

During the Russian campaign Germany's Luftwaffe was almost completely restricted to tactical missions. This photo shows a snowbound Russian village with burned-out houses and the remnants of a bridge (right).



Germany's massed air raids during 1940 by no means succeeded in crippling Britain's industrial potential. This photo shows docks and aircraft factories at Cowes, Isle of Wight, with the Saunders-Roe plant in the lower right corner. The white-outlined areas reveal the destruction after the Luftwaffe's strategic air offensive.

quisites. Firstly, the German bombers were by no means invulnerable, but suffered such heavy losses at the hands of R.A.F. fighters in the Battle of Britain that the offensive had to be broken off. The Luftwaffe's first Chief of Staff, General Wever, made a mistake when he thought that the speed of a then-modern bomber was so great as to place it beyond the ability of fighter aircraft to intercept it and shoot it down. His thinking was wrong because it was contradictory to a fundamental principle of aviation technology : any aircraft designed solely for speed *must* be faster than another aircraft having to haul an additional load of bombs and fuel. Secondly, the effects of the bombing were *over*estimated and the moral resistance of the population was *under*estimated. Instead of wearing it down, the hammer blows of the German bombing offensive steeled the British population.

As far as the Germans were concerned, the Russian campaign in 1941 absolutely killed any further thoughts of an independent air war after the Douhet pattern. After that the Luftwaffe became but an auxiliary branch of the army and was used as a sort of long-range artillery for making the Russian positions ripe for storming.

It is precisely at this point that the Douhetists deliver their argument. They maintain that in no country has Douhet's theory been put into practice to the last detail, neither in the armament stages preceding World War II nor in the waging of the actual war. Not even in the land of Hitler and Goering. Nevertheless, the idea of air warfare independently of the army and navy was more or less accepted in Germany during the initial years of building up the Luftwaffe. Then, the experience gathered in the Spanish Civil War brought about a fundamental change in thinking. In Spain the Condor Legion's 88th Bomber Group was put into combat solely as a medium of tactical support for the armies—as a replacement for the artillery, to wear down the "red" positions. To this came the fact that the results of high-altitude bombing attacks gave much to be desired as regards precision, this because the Germans neglected to develop gyro sighting equipment. This experience, again, led to a German overestimation of dive-bombing tactics and later to the technical error of developing heavy dive-bombers such as the Junkers Ju 88.

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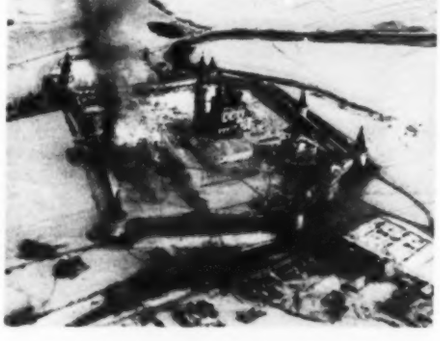
It is evident, therefore, that the German war conduct provided no practical example of the Douhet theory. Nevertheless, another interesting question is whether the Anglo-American air offensive was directly responsible for Germany's collapse. The day-and-night bombing attacks were delivered with increasing severity against the main German cities, for the dual purpose of rendering the population war-weary and destroying the armament production facilities. The gaining superiority of the Allied air forces accompanied by the weakening of the German fighter and anti-aircraft defences led, towards war's end, to a mastery of the air in the Douhet sense.

Stukas attack Terjajewa, northwest of Moscow.

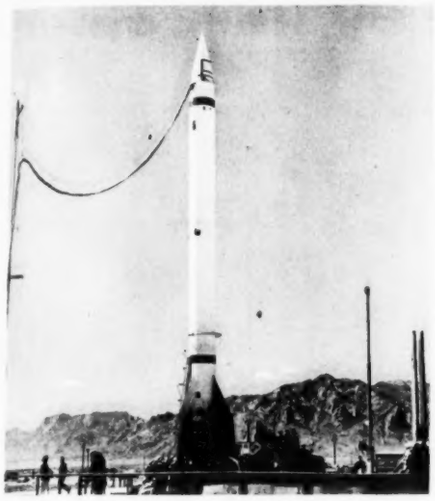


Indeed, the German war production and transport system was crippled to such an extent at the beginning of 1945 that, for example, a new weapon such as the jet fighter could no longer reach the front lines. On the other hand, however, the German population showed itself to be amazingly tough and morally resistant—a fact by no means explained through the political system of dictatorship. Therefore, would Germany have capitulated *solely* under the influence of the Allied air attacks, without the Normandy invasion in June, 1944—without the Anglo-American armies entering Germany from the west and the Russian armies from the east ? This is hardly imaginable, not even if one takes into account the ever increasing magnitude of the bombing attacks (Dresden, for instance).

And the warfare methods practised by the U.S.A. against Japan ? As will be remembered, Admiral Nimitz's offensive in the Pacific took the form of a series of hops from island group to island group. Each new jump ahead was systematically prepared by bombing attacks, which were followed by combined landing operations involving the Air Force, Navy, and landing troops. A strategic air offensive against Japan, her power installations, munitions industry and population, was excluded from the very start because of the great distances over water. Thus a beginning could only be made once the island bases on the Marianas (Saipan and Okinawa) had fallen into American hands.

But in the war against Japan there existed doubts on whether the Japanese islands could be forced to capitulate *solely* by bombing attacks. The final phase of that war was to have been the landing on Japanese soil and the conquest of the entire Japanese territory. America's leaders foresaw tough Japanese resistance which could be broken down only at the penalty of severe U.S. losses. These considerations ultimately brought about Truman's decision to use the *atomic bomb*. This new and terrible weapon resulted in Japan's capitulation within a few days. Thus here at least, Douhet came into his rights, and in a measure beyond his wildest dreams. In the atomic bomb there was born an instrument of destruction against which no protection is yet known to exist. And if the bombers carrying A-bombs deep into enemy territory perhaps can still be intercepted and shot down by fighter aircraft, there nevertheless remains the possibility of using, in place of manned bombers, rocket-propelled guided missiles (of the V-2 type) which travel at such high speed that any means of defensive interception seems hopeless.

But even if we disregard the atomic bomb, the Douhet theory on the ability of the air force to secure the final victory in war is, nevertheless, substantiated more and more



The differences of opinion between the U.S. Air Force and Navy are concerned with whether the Navy should participate in strategic air operations or leave them entirely to the Air Force.
Left: Martin Aircraft's "Viking" long-range research rocket, built for the U.S. Air Force.
Right: Guided missile built for the U.S. Air Force by North American Aviation.

with every progress made in aeronautical technology. Wittingly or unwittingly, it will be carried through in a future war. The present controversy between strategic and tactical air forces must be thoroughly clarified, for the long-range bomber which, with jet propulsion, operates at around 30,000 ft. and at more than 500 m.p.h., is becoming more and more different, technically, from the aircraft designed to give tactical support to land and sea operations. Therefore, it will become less and less possible to have the strategic air forces participate in the land battles of an army and the sea conflicts of a naval unit, or, conversely, to have the auxiliary air arms of an army or navy participate in strategic bombing operations.

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This brings us back to the U.S. Defence Secretary's cancellation of the Navy's projected Super Carrier. For, when we weigh up the facts of the bitter controversy between the U.S. Navy and U.S. Air Force, it is evidently a struggle between strategic and tactical air force concepts. Due to the particular characteristics of their weapons, the Air Force and the Navy (including carrier-borne Naval Aviation) would be destined, in a future war, to play *different* rôles in *different* theatres of action. The fact that the U.S. Navy is hanging so desperately on to its dream of a Super Carrier is not only born of the natural desire to obtain the biggest slice of the Defence Budget cake. There is more in it than that. In a future war, should the Navy participate in strategic air war operations or should it be confined to tactical missions? Since Pearl Harbour it has become clear that battleships are defenceless without air reconnaissance and fighter escort. The strength of a modern naval unit lies just as much in its aircraft carriers as in its battleships—a statement which is substantiated by the fact that the commander of a modern fleet formation frequently chooses an aircraft carrier as flagship from which to direct the operations, and not, as in earlier days, a battleship. The hitting power of a modern fleet formation is contained equally as much in its carrier-borne bombers as in the heavy guns of its battleships. The new core of a naval force is the "flying battleship."

In any case, the U.S. Air Force is preparing to take part in sea warfare—using, for example, a battleship mockup in the California desert.

Meanwhile, the U.S. Navy has no desire to content itself with the carrier-borne auxiliary air arm necessary for naval warfare. For such a tactical mission the now available twenty-one carriers would suffice—three of which are the so-called battle-carriers of about a thousand feet in length. No, the U.S. Navy is bent on participating in strategic operations—the natural rôle of the U.S. Air Force. In order to do this it would need heavy, long-range bombers capable of carrying huge bomb loads, and, to put them into operation, larger carrier ships with longer flight decks. With this in mind, the keel was laid of the Super Carrier, U.S.S. "United States."

But the Navy's ambition to compete with the Air Force in the field of strategic air war is without practical justification. As a matter of fact, the Pacific war against Japan proved clearly enough that bombers can be operated far more efficiently and economically from island air bases than from carrier decks. There are also technical grounds for this assertion: flight operations from aircraft carriers are complicated and highly vulnerable to enemy counteraction. When the U.S. Navy conquered, *alone*, the island base of Iwo Jima, situated some 700 miles from Japan, using Carrier Task Force No. 58 with eleven heavy and five light carriers, eight battleships and seventeen cruisers, it had to pay a disproportionately high price for the privilege of undertaking a strategic air mission.

At present the U.S. Army, Air Force and Navy are subordinate to the Secretary for Defence. From this unification must follow a clear-cut distribution of duties among the three services in a future war—in which the only opponent, we may safely say, would be the Soviet Union and its satellites. The U.S. Navy's mission in such a war would be to obtain and maintain control of the sea routes between the North American continent and the bases close to Russia. Its opponents at sea would consist chiefly of Russia's submarines, as the Soviet surface navy is far inferior to the U.S. Navy. With this mission accomplished, Naval Aviation could participate in land operations in European, Near and Far Eastern theatres of war. However, for this, the Navy's bombers, fighters and reconnaissance aircraft would not take off from carrier decks but from airfields in Great Britain, France, Turkey, Japan. Strategic air missions against the Soviet war potential would be assigned solely to the U.S. Air Force—specialists in strategic air warfare, who have learned their job thoroughly. The Navy, on the other hand, specialises in tactical bomber operations, for which the carrier ships form the basis.

Thus we see that General Douhet's ghost today stalks Washington's Pentagon—and surely Moscow's Kremlin, too.

R. K.

Assault by Helicopter

"Man helicopters" has been sounded, and seven fully combat-equipped Marines enter each Piasecki HRP-1 twin-rotor helicopter. Only one pilot is needed. The scene is at the Marine Corps School at Quantico, Va., where a simulated carrier deck has been painted on the runway.

Engines and rotors are started and the signal to "Launch Helicopters" has been given. The leading "Sagging Sausage" makes a fast getaway as "deck" crewmen dash to help get the other HRP-1s off in the split-second timing of the manœuvre.

Military commentators claim that tomorrow's war always starts with the weapons used in yesterday's conflict. While this was true in past wars to a certain extent, today's military men are making every effort to make World War III—which, they simultaneously hope, will never come—a bigger and more spectacular show than its predecessors.

Development of equipment for the "next war" does not stop at weapons intended to fill entirely new strategic concepts, such as atomic projectiles, "push-button" missiles, long-range rockets, global bombers, etc. It extends down the line to equipment used for conventional tactical assignments, such as the conquest of an enemy-held coast by the poor foot-slogging (as soon as they have landed) infantry.

For some time leaders of America's oldest military branch, the U. S. Marine Corps, have felt that the "old type" of amphibious landing (it was perfected only during the last war!) used in the invasion of Normandy and in the attack on various Japanese island fortresses in the Pacific, is obsolete and must be replaced. The Marines, therefore, set out to perfect the newest invasion technique—assault by helicopter.

Under the cover of a smoke screen and aerial fighter support, the HRP-1s are coming in low and fast to the "attack" zone.

The helicopters land, and troops rapidly disembark and take up positions for a conventional infantry line of attack. The operation required only 26 seconds, in which time the troops had disembarked and the helicopters departed from the area.

Invasion operations of this nature would become inevitable, Navy and Marine Corps strategists affirm, if another continent were suddenly occupied entirely, and resulted in America being involved in a war. Assault helicopters would then indeed form the solution to the problem of landing shock troops on enemy soil without excessive loss to the invaders.

Equipped with Piasecki HRP-1 tandem-rotor helicopters, carrying seven fully equipped soldiers, America's crack force of shock troops is working out tactics at the Marine Corps Air Station near Quantico, Va., and aboard the light aircraft carrier "Palau," for landings from fast aircraft carriers behind enemy lines and at other critical points. General Clifton Bledsoe Cates, Commanding General of the Marine Corps, says: "Combined with such things as the fast carrier and the troop-carrying submarine of the future, the helicopter will become a spear-head of amphibious warfare." Formations of assault helicopters would be escorted by ground-strafing and smoke-laying Marine Corps jet fighters (Grumman "Panther," etc.).

One great advantage of the large helicopter in assault operations is that dispersion of ships from which they take off is possible—and dispersion is considered the most effective antidote to atomic bomb attack on fleet formations.

Large helicopters will act not only as a means of bringing in fully armed combat troops with their fire-power, but also as "flying cranes," returning to base immediately for more supplies—or another load of men. In the past, once paratroops and glider-borne infantry had been committed for action they lost their mobility. Helicopters, by contrast, could be used for evacuation as well as assault.

The Piasecki HRP-1 helicopter, the "Sagging Sausage," is, of course, only the beginning in the assault helicopter field. Marine Corps chiefs really want one which could carry forty or fifty men, or field artillery pieces, light and medium tanks.

A gun crew rushes up to man a 75-mm. pack howitzer, about to be released from an HRP-1.

Another helicopter reduces altitude until its howitzer (centre, foreground) touches the ground. The 75-mm. gun is then released by a pilot-operated quick-release device. The gun crew mans the gun and the helicopter departs from the area. Within two minutes this howitzer was firing on "enemy" positions.

The British Aircraft Industry

BY C. G. GREY, LONDON. (PART V)

The de Havilland Enterprise

One outstanding peculiarity about the de Havilland business is that the de Havilland name (D.H.) is a good deal older than is the firm which makes D.H. aircraft. Young Geoffrey de Havilland lived near Newbury in Berkshire. He had acquired an engineering training at the Crystal Palace School of Practical Engineering, where, incidentally, I also, some years before, had learned to file a square and not to hit my thumb with a hammer. But Geoffrey de Havilland went on and became a real engineer.

As a hobby, he, with the help of F. T. Hearle, built a pusher biplane at his home and flew it tentatively in 1908-09. When the Royal Aircraft Factory at Farnborough started to make aeroplanes in 1910-11, Geoffrey de Havilland was taken on as a designer. And in 1911 he designed, and in 1912 produced, a tractor biplane with an eight-cylinder Vee-type Renault engine of 70 h.p., which flew very well.

This was called the B.E., which stood for Blériot Experimental, because Blériot was esteemed to be the father of all tractors, as Farman was of all pushers. Later on when the factory was derided for being all-French, B.E. was said to stand for British Experimental and F.E. for Fighter Experimental. Be that as it may, the B.E., piloted by Geoffrey de Havilland himself, went through all the tests in the Military Aeroplane Trials of 1912 and did better than any other competitor, British or Continental. But as an official product, it was *hors concours* and could not be given a prize.

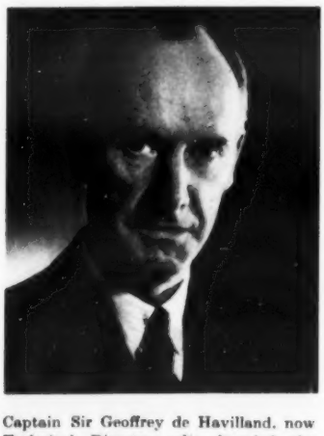
Thereafter, the factory progressed to other types. The B.E. 2 and 3, and the ill-reputed B.E. 2c, were not de Havilland's designs—and he was almost killed when an S.E. (scout experimental) spun into the ground with him.

In 1912 George Holt Thomas, who had big money in the old weekly *Graphic* newspaper and had been interested in flying ever since the world's first flying meeting at Reims in 1909, started the Aircraft Manufacturing Co., Ltd., at Hendon. He had imported Louis Paulhan, the Frenchman, in 1909 to give Londoners their first sight of flying, at Brooklands motor track, and had imported Paulhan again in 1911 to win the London-Manchester £5,000 prize—which was when Hendon began as an aerodrome.

Geoffrey de Havilland's first aircraft. He built it with the help of F.T. Hearle, still a member of the de Havilland Board, in 1908-09. It crashed on its first flight.

Geoffrey de Havilland's first machine that flew. On it Geoffrey taught himself to fly in 1910.

The Aircraft Manufacturing Co., Ltd., had a row of sheds on Hendon Aerodrome and built a great factory alongside the main Edgware Road opposite Colindale Avenue, which led to the aerodrome. Holt Thomas at first held the British Empire agency for Henry and Maurice Farman pusher biplanes, but in 1914, before the war, he persuaded Geoffrey de Havilland to join him as chief designer.



Captain Sir Geoffrey de Havilland, now Technical Director, who founded the company with Holt Thomas.

C. C. Walker, now Chief Engineer, who has been Geoffrey de Havilland's engineering mainstay since the beginning.

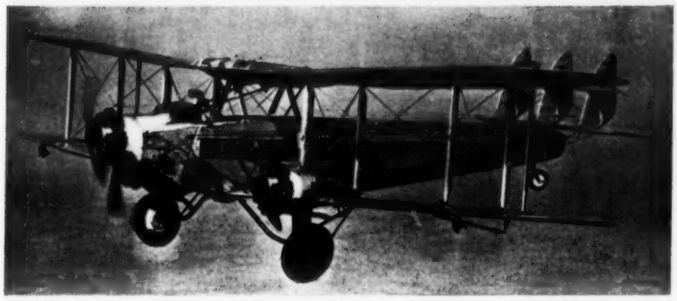
H. T. Hearle, Member of the Board, who helped build the first D.H. aircraft.

W. E. Nixon also joined the company in the early days. He later became Secretary, now is Managing Director.

Francis St. Barbe, another early associate, is an exceptionally able business man and is now Business Director.

THE "HARD CORE" OF THE DE HAVILLAND ORGANIZATION

The renowned D.H. 6, or the "Clutching Hand." If it was dived too steeply it turned over on its back. It was quite stable upside down...



The "Hercules" was produced for Imperial Airways in 1926, more or less as a side-line. It carried 14 passengers.

Then began the famous series of D.H. aeroplanes which have made aeronautical history. Geoffrey de Havilland was soon joined by C. C. Walker, who has been his engineering mainstay ever since ; by his old associate, H. T. Hearle ; by W. E. Nixon, later Secretary and now Managing-Director ; and by Francis St. Barbe, an exceptionally able business man and now Business Director. These were, and have remained, the "hard core" of the de Havilland organization.

The D.H. 1, a two-seat pusher biplane with a gun in front, appeared before the war. G. de H., who was a Captain in the Royal Flying Corps Reserve, was ordered off to France when war began, but he was quickly dragged back again as being much more useful as a designer than as a war-pilot. His second type, the D.H. 2, a very small single-seat biplane with a gun in front, was astonishingly manœuvrable and did great execution among the enemy until it was beaten for speed by the Fokker monoplane with a gun firing through the airscrew by means of an interrupter gear.

The next notable type was the D.H. 6, a slow trainer biplane, with such a camber on the leading edge that it could not be stalled and was known as the "Clutching Hand." But if it was dived too steeply it turned over on to its back, and hardly anybody could get it back again. It was quite stable when upside down and spun slowly into the ground, often without killing the pilot.

The D.H. 9, of Easter-time 1917, was the next D.H. success. At a distance it looked like an innocent B.E. 2c, and an easy victim. In fact it was very fast with its B.H.P., and later Puma, engine and had a sting in its tail from a gunner behind the pilot. It did great execution.

It was followed later in the war by the D.H. 9a (known as the "Nine-ack"), which had a curious history. When the D.H. 9 became obsolescent in 1918, the new Air Ministry wanted to use up a mass of D.H. 9 fittings, but they wanted a bigger engine (Rolls-Royce or Napier, and ultimately the Liberty from the U.S.A.). More weight meant bigger wings and stronger fittings, a bigger engine meant a bigger fuselage, and that meant bigger tail surfaces and ailerons, so, at the finish the 9a was a different aircraft. It was built largely by Westlands and not by Airco, as the Aircraft Manufacturing Co. was called.

The last wartime D.H. was the D.H. 10, a twin-engined bomber, which was not largely used.

When the war stopped in 1918, Holt Thomas organized a semi-official airline to Paris and to the Army of the Rhine and had D.H.9s modified to carry two passengers. And then a tragedy befell.

Like many people, firms outside the aircraft industry foresaw a boom in aviation after the war, for everybody had been talking Air Power. So the Daimler-B.S.A. (Birmingham Small Arms) combine bought the Airco and Holt Thomas' Aircraft Transport & Travel Co., which started a regular airline in 1919. But in 1920 came the usual

A. E. Hagg, de Havilland's Chief Designer, built the original "Comet" in 1933. It won the England—Australia Race of 1934. Picture shows the then Prince of Wales, now Duke of Windsor, talking to the pilots of the winning aircraft, C.W. A. Scott and T. Campbell Black.

Airline types to be built included the all-wood four-engined "Albatross" of 1938. Originally intended for the North Atlantic, it never went into regular service on the route and was not a great success.

The D.H. 95 "Flamingo," also of 1938, had two Bristol "Pegasus" engines. It was a promising machine but went out of production at the beginning of the war.

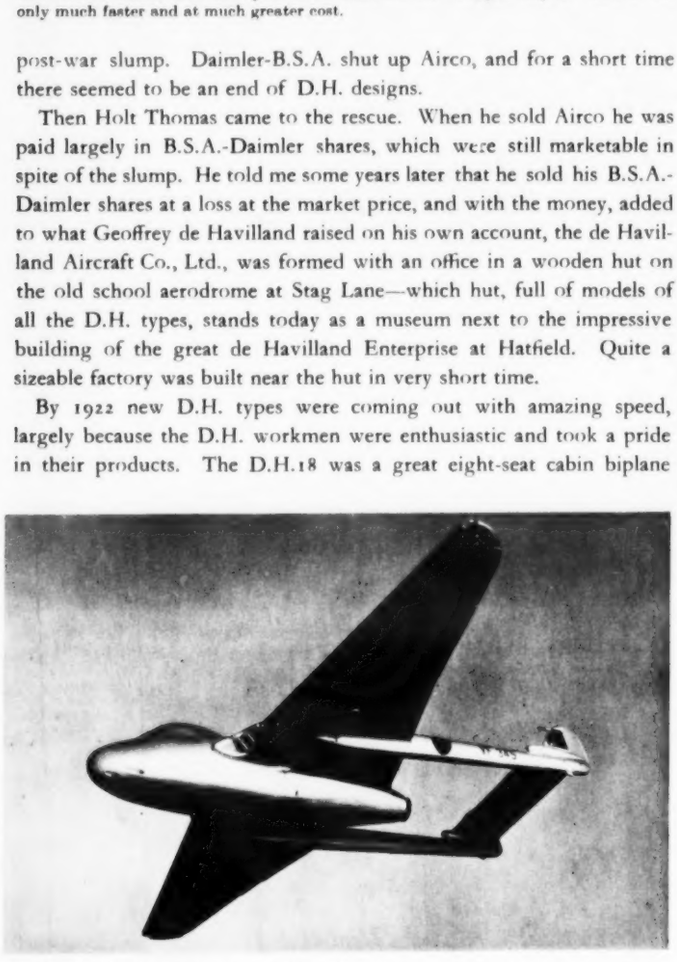
A. E. Hagg's two-seat "Mosquito," of 1940, the greatest D.H. triumph. As a fighter and a bomber the type was one of the most formidable weapons of the war. A single-seat successor, the "Cornet," was a little too late for the war and still equips some of Britain's first-line squadrons.

The "Dove" feeder liner does just about what the old "Dragon Rapide" used to do, only much faster and at much greater cost.

post-war slump. Daimler-B.S.A. shut up Airco, and for a short time there seemed to be an end of D.H. designs.

Then Holt Thomas came to the rescue. When he sold Airco he was paid largely in B.S.A.-Daimler shares, which were still marketable in spite of the slump. He told me some years later that he sold his B.S.A.-Daimler shares at a loss at the market price, and with the money, added to what Geoffrey de Havilland raised on his own account, the de Havilland Aircraft Co., Ltd., was formed with an office in a wooden hut on the old school aerodrome at Stag Lane—which hut, full of models of all the D.H. types, stands today as a museum next to the impressive building of the great de Havilland Enterprise at Hatfield. Quite a sizeable factory was built near the hut in very short time.

By 1922 new D.H. types were coming out with amazing speed, largely because the D.H. workmen were enthusiastic and took a pride in their products. The D.H.18 was a great eight-seat cabin biplane



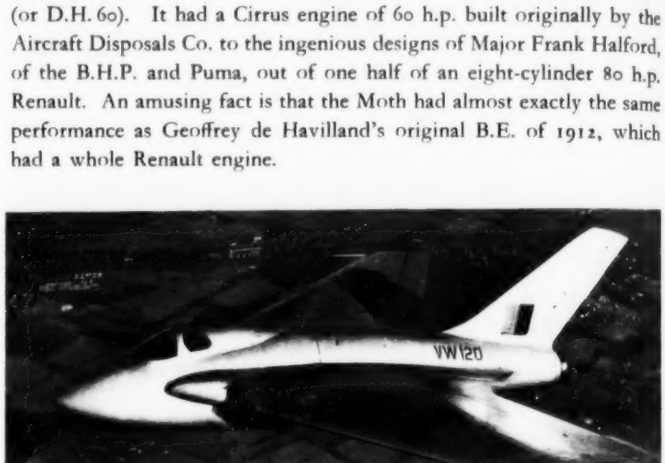
The de Havilland "Vampire" jet fighter. Numerous countries in Western Europe and Asia have ordered it.

with a 450-h.p. Napier Lion engine, in which the pilot sat outside behind the cabin. The D.H. 34 was rather like it, but took 10 passengers, and the pilot sat up in the nose, just behind the engine and in front of the upper plane, so that if the machine hit anything, he was "it." In between those numbers were others, both Service and civil types, but some numbers were only projects on paper.

About 1922 a wealthy and able young man named Alan Butler, who was just old enough to become an officer in the Guards during the war, began to take an interest in flying. He had big interests in timber in Newfoundland. He owned a big steam yacht and qualified for a Master's Certificate to navigate it. He financed air surveys in Newfoundland and the Labrador, and seal-scouting expeditions. So when he came home he learned to fly at the London Aeroplane Club at Stag Lane, a sort of appendage of the D.H. Co., and got the firm to design and build a three-seat biplane for him, with a Rolls-Royce Falcon engine. (He called it "Lois" after his wife, who herself became a very fine pilot and during the war used to deliver Mosquitos and four-engined bombers to the R.A.F. as a pilot of Air Transport Auxiliary.)

This machine, the D.H. 37, was like a small D.H. 9, or a big Moth, and typified all D.H. designs. Seen at a distance broadside-on all D.H. craft have a family likeness.

In 1924 there was a Light Aeroplane Competition at Lympne, promoted by Air Vice-Marshal Sir Geoffrey Salmond, Technical Chief at the Air Ministry, who persuaded the Ministry to put up prizes. From the mixture of comic types entered for the competition evolved, after it was all over, one of the World's most famous aircraft, the Moth (or D.H. 60). It had a Cirrus engine of 60 h.p. built originally by the Aircraft Disposals Co. to the ingenious designs of Major Frank Halford, of the B.H.P. and Puma, out of one half of an eight-cylinder 80 h.p. Renault. An amusing fact is that the Moth had almost exactly the same performance as Geoffrey de Havilland's original B.E. of 1912, which had a whole Renault engine.



Three D.H.108 "Swallow" tailless experimental jet aircraft have been built. One of them attained supersonic speed (although in a dive) in September 1948. Two years earlier, in September 1946, de Havilland's Chief Test Pilot and the founder's eldest son, Geoffrey de Havilland, lost his life during a high-speed flight test in another of the three machines.

Here, or hereabouts, Alan Butler put enough money into the D.H. concern to free it from all financial anxieties, and thenceforth its history was one of continuous success. He is now Chairman of the whole D.H. Enterprise.

After the Moth (so called because de Havilland himself is an ardent lapidopterist) came the Puss Moth and the Tiger Moth and the Fox Moth and the Hawk Moth, which spread all over the world with the pertinacity of their insect namesakes. The firm practically gave up bothering with war-planes, but more or less as a side-line it produced in 1926 the Hercules, a three-engined (Jupiter) 14-passenger liner, for Imperial Airways, which was used for a long time on the South African route and on the Cairo—Karachi line.

The first Tiger Moth was a tiny single-seat monoplane racer with a 100-h.p. D.H. engine. In it Hubert Broad put up a Light Aeroplane International Record of 186.4 *miles* per hour over 100 kilometres. This D.H. engine, built to Major Halford's design, was the forerunner of the immense series of Gipsy engines. Halford left the Aircraft Disposal Co. and definitely joined D.H. The Tiger Moth, as a name, was given years later to the famous biplane trainer of the 1930-40s.

Halford's products at D.H.'s are enough to fill a book in themselves. Gipsy engines, four-cylinder upright, four-cylinder upside-down, six-

De Havilland's latest product, the D.H. "Comet" four-engined jet airliner which started its flying trials last July 27th. The aircraft has already made a 2 3/4-hour non-stop flight without any unpleasant symptoms. Its appearance created a furore in British and American air transport circles.

cylinder upside-down (inverted), have each in turn beaten all records for length of running between overhauls. Then he made a Vee-type with two lots of Gipsy cylinders. Then he made a Vee-Type with two lots of Gipsy cylinders. Then he made an H-type with *four* lots of Gipsy cylinders. And here he side-tracked for a time to design the Napier Sabre, 24-cylinder water-cooled horizontal engine, for our biggest fighters in the war.

But after that he came back to D.H.'s to design the Ghost and Goblin turbojet engines, which have been the power plant of the record-breaking Vampires. And he is still going on, after working gallantly all through a long illness before the war. The D.H. engine works, both for turbines and piston engines, under Aubrey Burke are a model of engineering organization.

The Moths, in their various manifestations, kept D.H.'s busy until 1933 when A. E. Hagg, their chief designer, produced the first Comet, which won the England—Australia (Mildenhall—Melbourne) race of 1934, and beat a heap of records (New Zealand and back, Baghdad non-stop, England—Calcutta, etc.). Subsequently, sundry airline types were built, notably the Flamingo and the Albatross twin and four-engined types.

One of the great financial successes was the D.H. 84 Dragon of 1933, a biplane with two 130-h.p. Gipsy engines, which carried eight passengers, pilot and radio man, at an operating cost which allowed a reasonable profit margin. A later type in 1934, the Dragon Rapide, with tapered wings and six-cylinder 200-h.p. engines, and faster, did even better. Then later still came the D.H. 86, an enlarged version of much the same thing, which carried 16 passengers on four six-cylinder 200-h.p. Gipsy engines.

These aircraft cannot be built today at a price which would allow operators to run them at fares which passengers would pay.

But the greatest D.H. triumph came during the War, when in 1940 Hagg produced the Mosquito, very like a grown-up version of the Comet. It was one of the most formidable weapons of the war. Its speed, with Rolls-Royce Merlins of various "Marks" ranged from about 400 m.p.h. to close on 500 m.p.h. according to whether it was equipped as a bomber or a stripped long-range photographic machine. Its successor, the Hornet, has a still finer performance, but it was a little too late for the war.

The post-war triumph of D.H.'s is the Vampire turbojet fighter. It has beaten the world's height record. It is being bought by numerous countries in the Western, or Atlantic, area of Europe, as well as in Asia and South America. And it is being built on a wartime assembly-line scale by the great English Electric Co., Ltd., of Preston, in their Dick Kerr works. Its companion jet type, the D.H. 108, without a tail and with swept-back wings, is still experimental.

As an antidote to these warlike activities the de Havilland Aircraft Co. have produced the Dove (of Peace, we hope), a very pretty twin-engined low-wing monoplane, which does just about what the Rapide used to do, only much faster and at much greater cost. There is a hope that the three-engined Drover, built by the Australian de Havilland company, may recapture some of the commercial traffic.

The latest of all D.H. products is the new Comet, a passenger liner with swept-back wings and four turbojet D.H. Ghost engines of unmentionable power. It is the first jet-propelled aircraft to be designed *as* a passenger liner, from the drawing-board upwards. Its initial experimental flights have been very satisfactory. Calculations claim that it will cruise at 500 m.p.h. at 40,000 feet. So that D.H. prospects seem as bright as the firm's past achievements.

George Holt Thomas started Aircraft Manufacturing Co.—D. H. predecessor—in 1912, organized an airline to Paris in 1919, helped finance The de Havilland Aircraft Co.

Alan Butler, now Chairman, who in 1924 put enough money into D.H. to free it from all financial anxieties.

Major Frank Halford, Chairman and Technical Director, The de Havilland Engine Co., the ingenious designer of D.H.'s piston and turbine engines.

Books Received

(Reviews of a selection to appear later)

How to Draw Planes, by Frank A. A. Wootton. The Studio, London & New York.

Wind Tunnel Testing, by Alan Pope. John Wiley & Sons, Inc., New York; Chapman & Hall, Ltd., London.

Le Radar, by R. Faure. Gauthiers-Villars, Paris.

Mitteilungen aus der Versuchsanstalt für Wasserbau und Erdbau an der Eidg. Techn. Hochschule in Zürich. Published by Verlag Leemann, Zurich.
No. 14 *Erdbauliche Methoden zur Dimensionierung der Pisten beim Bau des Flughafens Kloten*, by Prof. Dr. R. Haefeli and Dipl.-Ing. W. Schaad. — *Die Arbeiten der Erdbauabteilung der Versuchsanstalt für Wasserbau und Erdbau E.T.H.*, by Dr. A. von Moos and Prof. R. Haefeli. — *Erdbaumechanik und Geologie*, by Dr. A. von Moos and L. Bjerrum.
No. 15 *Beobachtungen im Firn- und Ablationsgebiet des grossen Aletschgletschers*, by Prof. Dr. R. Haefeli and Dipl.-Ing. P. Kasser. — *Setzungsmessungen 1887 bis 1944 und Baugrund im Rutschgebiet von Zug*, by Dr. A. von Moos.

Mitteilungen aus dem Institut für Aerodynamik an der Eidg. Techn. Hochschule in Zürich. Published by Verlag Leemann, Zurich:
No. 15 *Anwendungen der elektrolytischen Methode auf die Betz'sche Theorie der Spaltverluste an Schaufelgittern*, by Dr. Mahmoud Ali Hassan.

Cours d'Aérotechnique, by G. Serane. Dunod, Paris.

Encyclopédie de l'Electricité et de la T. S. F. à bord des Avions modernes (Vol. 3), by Henry Lancy. Librairie des Sciences pratiques, Desforges, Paris.

Introduction to Gas-Turbine and Jet-Propulsion Design, by C. A. Norman and R. H. Zimmerman. Harper & Brothers, New York.

Gesetzmässiges Verhalten der Klopfbremsen, by Theodor Hammerich. Verlag W. Girardet, Essen.

Jahrbuch der Rheinisch-Westfälischen Technischen Hochschule Aachen 1949. Published by Verlag W. Girardet, Essen.

Publications scientifiques et techniques du Ministère de l'air. Distributed by Service de documentation et d'information technique de l'Aéronautique, Paris:
No. 226. *Chronophotographie des champs aérodynamiques*, by Joseph-Maurice Bourot.
No. 227. *Applications de la mécanique aléatoire à l'hydrodynamique et la mécanique quantique*, by J. Bass.

La Police de l'Air, by E. M. Bornecque. Les Editions Internationales, Paris.

La Radionavigation aérienne, by Robert Leprêtre. Charles-Lavauzelle & Cie, Paris.

Aircraft Engines of the World, by Paul H. Wilkinson. Paul H. Wilkinson, New York.

Air Touring Guide to Europe. Edited by the Private Aviation Division of the F.A.I., Royal Aero Club Aviation Centre, London.

Der Letzte Monat, by Karl Koller. Norbert Wohlgemuth Verlag, Mannheim.

Must We Hide? by R. E. Lapp. Addison-Wesley Press, Inc., Cambridge, Mass.

Flugfunk/Flugsicherung. Special number of "*Pionier*," official publication of the Swiss Federal Association of Communications Troops and the Union of Swiss Field-Telegraphy Officers and Non-Commissioned Officers (Eidg. Verbandes der Übermittlungstruppen und der Vereinigung schweizerischer Feldtelegraphen-Offiziere und -Unteroffiziere), Zurich.

Not in the Script

BY SCHOLER BANGS

Her slight, formal smile had a measure of summery warmth, and was inquiring.

Her hair was silvery blonde, and the natural beauty of her slender figure suffered little concealment from the lacy evening gown she wore.

"By all means," we said, "two more !"

She drifted away into the obscurity of the low golden haze of the taproom's dimmed lights and we could hear her voice in the distance, lilting—with waitress authority.

"Two beers !"

The stuff was good and cold, and the Red Baron was in good humour.

"Imagine ! With a broken neck, a very freshly broken neck, he had to have his game of pinochle. Before going to a hospital !"

Rittmeister Manfred von Richthofen, 80 victories, laughed quietly.

Dead ? The Baron ?

Very much alive, I should say.

Outside the full moon spilled radiance upon

Paul Mantz, Hollywood stunt pilot and photographer. He won the Bendix Trophy trans-Continental race of the National Air Races in 1946.

This first-published photo of the movie crash executed by Paul Mantz on August 9th, 1949, shows a relatively "safe" stunt which will be only a brief, if costly, scene in a Twentieth Century Fox production, *Front and Center*. Note that the wheels of the fuselage are off the ground—and also all four feet of the uniformed actors leaping to escape the stripped wings hurtling towards them. They made it ! To make the wings of the Stearman trainer come off upon impact, the spars were partly sawed through and the bracing wires were moved from their original attachments.

Hollywood, and a stone's toss from the brittle blinking of neons at Hollywood Boulevard and Vine Street we had found this convenient spot in which to wonder that filmland's professional flying "aces" should live so long.

The monthly meeting of the Associated Motion Picture Pilots had just ended in the Hollywood Roosevelt Hotel, a meeting at which Howard Batt, President, had glanced at the faces about him and had shaken his head in sudden realisation.

"Why, a lot of us are grandfathers !"

Frank Tomick, considerably more mature than when he was made up as the dashing leader of the Richthofen Flying Circus in "Wings," and who was born in Vienna and talks like a Swede, had the simple explanation :

"It just wasn't in the script, I guess, that we should be killed doing the things we did."

Sipping his beer thoughtfully, he said :

"For most of us the spectacular crash sequence is a thing of the past. What we're selling the studios today is experience ; our twenty years or more of camera know-how.

"Not that you will not be seeing spectacular crackups in films still to be produced.

"It is just that the studios are so surfeited with crash shots, made in the salad days of air thrillers, that they merely have to go into their libraries for a few feet of film, which may never have been used before, when the script calls for a mid-air collision or a plane diving into the ground."

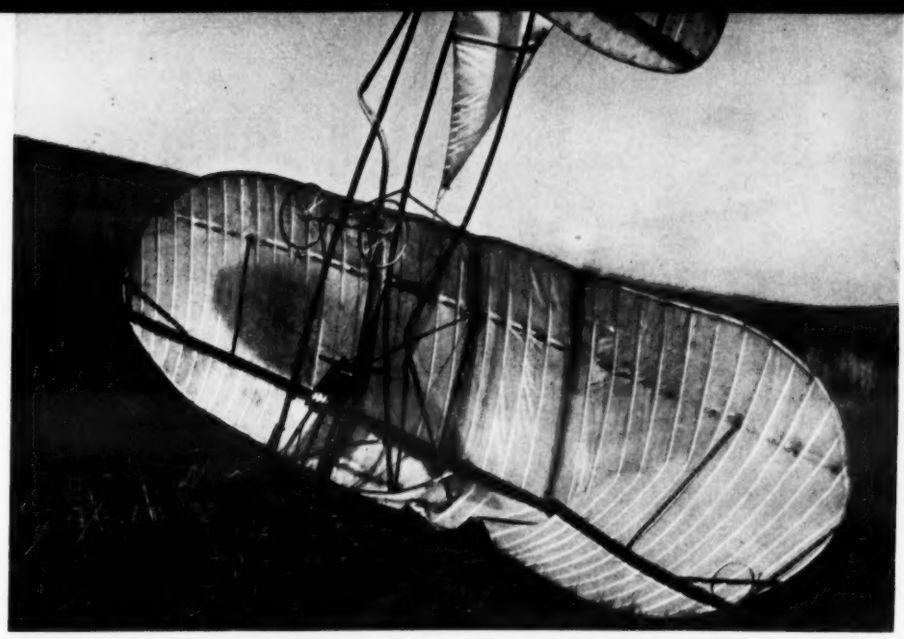
No more pinochle with a broken neck ?

Tomick nodded.

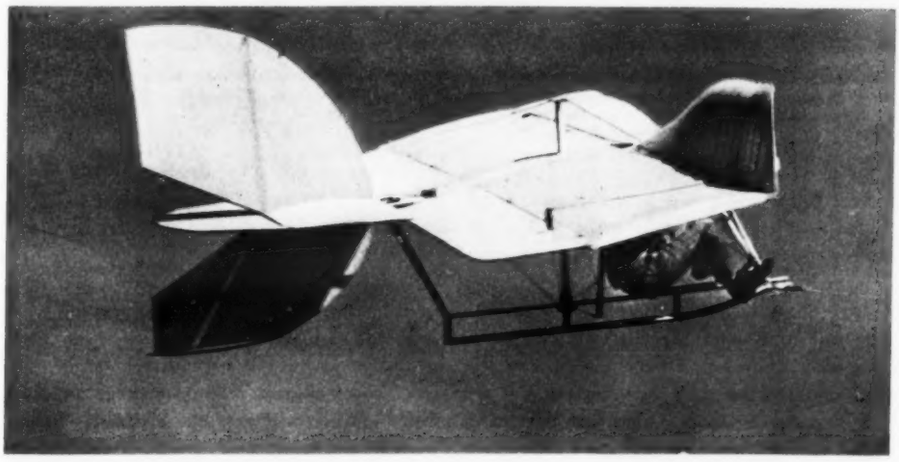
"That was a good one, though, and not many people know about it beyond the fact in filming *Wings* Dick Grace came out of a Fokker D-7 crackup with his neck broken.

"I was Baron von Richthofen, and Dick, as one of the officers of my squadron, was supposed to be shot down by strafing Allied planes just as he took off. Someone had forgotten to put a shoulder harness in the cockpit, and I told Dick he was foolish to try it. But he insisted that he could do it. The cameras were all set up, and he didn't want to delay things. You may remember it ? He was well off the ground, and then nosed down and hit on one wing. A beautiful crash ! I ran up to the wreckage and helped him out. The cameras were still rolling, and after he assured me that he was O.K. I signalled them to cut.

"Dick was a rabid pinochle player, and that evening he and El Brendel and I went into our usual game. Dick complained that his neck was a little sore, and after a while I noticed that it was beginning to swell horribly. He finally consented to go to a doctor—a chiropractor of all persons ! When we finally got him into a hospital the X-rays showed his neck had been broken in three places."



This crash *was* fatal. Successfully flown in more than fifty flight tests in the early days of aviation, John J. Montgomery's monoplane glider crashed at Evergreen Valley, California, in October 1911, after the inventor had suffered a vertigo attack and slumped over the controls. Montgomery died shortly after.



In *Gallant Journey* Columbia Pictures duplicated the adventures of John J. Montgomery. Death touched only lightly this studio version of the Montgomery glider, caught by the camera the moment its wing began crumpling on its first test flight with stunt pilot Don. C. Stevens at the controls. He escaped with a fractured ankle !

Re-built, the glider was flown successfully. Substitute pilot Paul Tuntland here receives advice from Stevens, on crutches. At left is Stan Polich, engineer for Radioplane Corp., Van Nuys, Calif., which built the glider.

This is a studio conception of a "secret" supersonic rocket aircraft, built of wood to the "designs" of Paul Mantz for $45,000.

Mantz got a cheque for at least $120 for taxiing the aircraft past the cameras. This is the minimum fee of Associated Motion Picture Pilots for taxiing at a location outside studio environs. This shot whill be in Warner Brothers' *Chain Lightning*, now in production.

Sit in at a meeting of Associated Motion Picture Pilots and you'll hear any number of "good ones" resurrected from the days when Hollywood was definitely overboard on aviation sequences, and a select little band of top drawer pilots—Dick and Frank, Leo Nomis, Roy and Al Wilson, Maurice Murphy, E. H. "Robbie" Robinson, Frank Clarke and the rest—could write their own tickets.

If a major aviation movie was not being filmed, in the late '20s and early '30s, they could always count on quickies—low-cost melodramas—and spine-tingling serials for a few days of flying. A movie thriller in those days was most second-rate if it had no hair-raising aviation sequences.

Today, with aviation movies in the doldrums, the two dozen active members of A.M.P.P. confess that between jobs they would grow hungry without regular income from other sources. Some manage airports. Some are personal airplane salesmen. Others are on the payrolls of Southern California's airplane factories as test pilots. Paul Mantz owns a booming airplane charter service. Col. Clarence A. Shoop, A.M.P.P. Secretary, is a Hughes Aircraft Co. executive. Tomick, when he isn't flying for the studios, is a motion picture sound technician—a smart studio executive figured that one who could keep his mind on the hundred-odd instruments and controls of a wartime four-engined bomber should be just about perfect behind the dials and knobs of a control board through which actors' voices flowed on to the sound-tracks of whirring cameras. Dick Grace spends his time "at liberty" writing profitable books and movie stories, and managing his real estate holdings.

But, with the optimism which makes them certain that "death is for the other fellow," they feel confident that Hollywood is just about due to break out in a fresh rash of aviationitis and flying assignments for all.

They're ready for it, too: all paid-up members of the Screen Actors Guild, with which A.M.P.P. is affiliated, they have a comfortable foundation of minimum wage rates.

Suppose that Howard Hughes' R.K.O. Studio wants an airplane taxied 30 feet past a group of actors within the studio grounds. The pilot's minimum paycheck for the chore will be $90. If it calls for continuous "work," the fee will be at the rate of $300 per week. On location, outside the studio, the price goes up. It is $120 a day minimum, or $300 per week plus $100 for each day in which flying is done.

Robbie Robinson, one of Hollywood's veteran movie pilots, says that few of the Association's members will work at the minimum rate and most are able to count on $200 a day and up. The "up," of course, applies

Filming those beautiful sky shots of aircraft "in combat" usually calls for improvising mounts for cumbersome cameras. Here Howard Batt, President of Associated Motion Picture Pilots, and Douglas ("Wrong Way") Corrigan inspect a camera mounted on a Stearman biplane. Adhesive tape is to dampen vibration and make certain that wind does not open up the film case in flight. — In July, 1938, "Wrong Way" Corrigan flew the Atlantic in an old 175-h.p. Curtiss "Robin" without U.S. clearance and upon arriving in Dublin declared his compass had packed up —he really wanted to fly to California but the compass had indicated the wrong way !

Good looks can be an asset to the movie stunt pilot, especially if the script calls for close-ups and a dashing moustache. Posing for this picture (years ago !) were Howard Batt, Frank Clarke and Paul Mantz. Careful Frank Clarke (centre) was killed in 1948 when the engine of his Vultee BT-13 basic trainer quit cold as he was making a climbing turn prior to a pasture landing at Frank Tomick's ranch.

Wham !... The hero crashes his "speeding" (?) aircraft though the top of a church steeple and sends two villains toppling down to their death or into the clutches of the law. The scene, from a forgotten thriller, called for nicely judged flying by the unidentified pilot of the old JN-4D, plus a few Hollywood tricks. The falling villains are dummies. The sturdy steeple is a breakaway, probably built of balsa wood and sawed timbering to disintegrate without causing the aeroplane to crash after the impact.

Curtains for the pilot? Not in the least! The pilot crashing this World War I "Spad" fighter was movie stunter Dick Grace, who now writes books and movie stories, manages his real-estate holdings and hopes to do "just one more" before he retires for good.

to special flying shots, such as stunt flying and precision formation flights. If it's to be a crash sequence, the fee will be the highest that the pilot can squeeze out of the studio without risk of having the producer shop around for someone who will do it for less. During the days when studios were frantically competing with each other to build up a backlog of bigger and better crash footage, Dick Grace demanded, and got, as high as $2,500 for a single crash.

Crash pay is on a negotiated basis, and in these days of dog-eat-dog A.M.P.P. members are reluctant to confide what they receive for the scattering of hazardous flights for which they are hired.

Stanley H. Reaver, chief pilot for Paul Mantz, mentioned at last month's association meeting that a studio had hired Mantz to fly a plane between two trees and strip off the wings in the crash. He neglected to mention the fee, but it probably was gilt-edged, although to hear him tell his plans for the stunt it should have been quite simple :

"We're going to use a Stearman trainer, a biplane, with the spars pretty well sawed through and the landing wires shifted from the centre section struts to the spars of the upper wings. The Stearman is built like a rock, and if we didn't doctor the landing wires the wings would never come off. The trees will be ten feet apart, and we figure on taxiing between them at just about flying speed. It shouldn't be hard—if Paul's aim is good."

Colonel Shoop dropped the word that he anticipates $5000 for a certain stunt he expects one studio to "buy." He would not identify either the studio or the stunt, but his association with Howard Hughes prompts speculation that it might be a jet fighter crash for R.K.O.'s forthcoming *Jet Pilot*.

You wonder that the elite of A.M.P.P. are able to land such admittedly desirable paychecks, especially with hundreds of footloose and equally reckless World War II flyers itching for a chance to climb aboard a studio gravy train.

"Only, it is far from a 'gravy train'," A.M.P.P. President Batt insists.

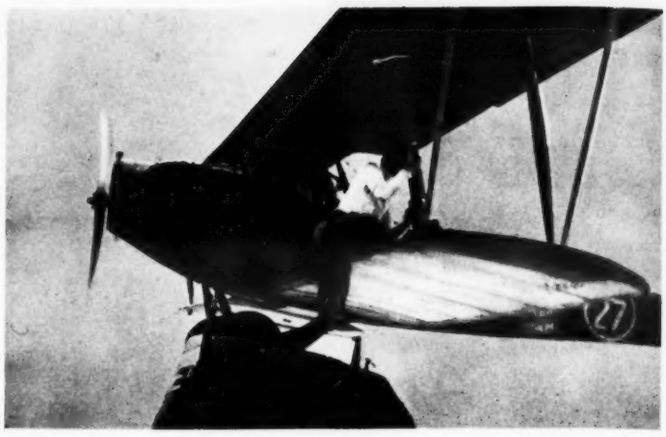
The assignment may be wholly devoid of hazard : a case of diving past a camera on the ground, piloting a camera plane to pick up a transport against a cloud background, or flying formation in a group of other planes.

"We're not just selling our flying ability. Good pilots are a dime a dozen today," admits Robinson. "What we're selling is practical experience—the difference between getting the picture in one 'take' and having to shoot the same scene over and over at a cost to the studio of hundreds of dollars a shot. We know camera angles and lighting, and how to manoeuvre so that when the cameras roll we are right there, filling up the film, and not just a moving speck in the distance. We know, for example, that flying a perfect formation may be deadly dull as the camera

In the heyday of air thrillers, stunt pilots kept in trim between movie assignments by barnstorming with air circuses.

Trick flying at county fairs kept them keyed up to the precision required of them under the baleful, glassy stare of Hollywood cameras.

Behind the scenes: Movie heroine Gladys Ingle was filmed for the first time, in 1928, escaping the villain by changing in mid-air to the aircraft of the rescuing "hero." Ace stunt cameraman Jerry Holscher stood with camera on the opposite top wing of the lower aircraft to record the scene. Piloting upper craft was Art Goebel, now U.S. Air Force Colonel.



When Gladys Ingle made the change, the weight of Cameraman Jerry Holscher, on the opposite wing, unbalanced the lower aircraft. The wings of the two machines touched and a fatal crash was averted by luck and good pilotage. A crash was "not in the script"!...

views it; one plane blotting the next from view. We know how to make the formation just ragged enough, shifting position as the camera angle changes, to appear smooth and perfect, with every plane showing, when it flashes on the screen."

Making the studios appreciate this, especially new producers, is the Association's No. 1 headache at the moment.

Says Dick Grace:

"Today there is hardly a studio executive who does not have one or two war pilot friends needing jobs. You can't blame them for wanting to give their friends a break. But it is likely to be costly, finally requiring one of us to come in to do the job right.

"Not long ago one pilot, who had never done movie work, was given the simple assignment of making a take-off directly over the camera crew. The cameraman asked this pilot to indicate exactly where he would leave the ground so that the cameras could be positioned accordingly. The pilot made a mark on the runway. But when he got there, on his take-off roll, he was just a fraction short on flying speed. The camera man ducked, but his equipment was smashed. Now if one of us had been doing it he would have started way back, holding the plane barely off the runway until ready to zoom over the camera. He would have plenty of speed and control, and there would have been nothing to it. Knowing those little tricks of the business is what makes us valuable to the studios."

A distinct air of conservative professionalism hangs today over the meetings of these death dodgers of yesterday's pictures. It is only when they tell of yesterday's exploits and misadventures that one can sense a certain ever-present tension among them and appreciation that even the most casual sequence may go wrong, sometimes with startling results.

Although his career once prompted Dick Grace to exclaim in amazement "I'm still alive!" and then sell the exclamation for a reasonably fat figure to R.K.O. as a movie title, relatively few of them have died with the cameras grinding.

While a number have been killed in spectacular crashes, all but one died "off the set." For example, careful, skilful Frank Clarke was gliding his Vultee BT-13 basic trainer toward a pasture landing at Frank Tomick's mountain ranch a little over a year ago, when, in a climbing turn, his engine quit cold. Frank died miles away from the cameras. A stunting military pilot looped into the wing of an early airline Ford Tri-motor Maurice Murphy was piloting. The down-wash of a helicopter at the National Air Races sucked into its whirling blades the flimsy open-air pusher flown by Al Wilson. There are at least two instances of movie pilots completing their chores before the cameras and then crashing to their deaths on the flight home from location.

Leo Nomis was the exception.

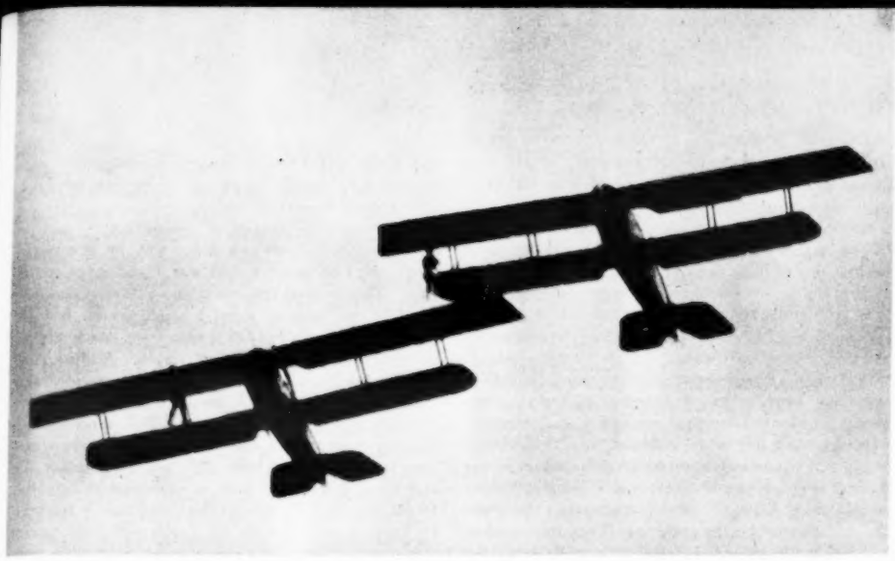
The studio wasn't pressing him, but they did want a shot of a plane spinning and recovering close to the ground. Six times while the cameras clicked, he had spun down and come out below the tops of nearby eucalyptus trees. Apparently dissatisfied, he climbed up above the waiting cameras a seventh time. His plane pulled up into an easy stall and then, perfectly positioned for the cameras, fell off into its spin. Leo was still spinning, or just starting to recover, when he hit.

There is hardly a member of A.M.P.P., however, who cannot relate one or more hair-greying "near miss" brushes with sudden death. It doubtless accounts for their acceptance that anything might happen, and probably will.

Robbie Robinson recalls the time when he and Nomis were supposed to be dive-bombing the enemy in a World War I picture.

"We were supposed to pull out of our dives just above spots where sixty-stick charges of dynamite were buried. As we

Fresh from barnstorming, the stunt man and his pilot could consider as routine (while convincing studios it was super-hazardous) a change from an aircraft to the top of a swaying railroad Pullman coach.



Safe at last ! Gladys Ingle now has only to clamber to the cockpit of the hero's aircraft. Cameraman Holscher is seen working his way in towards the fuselage of the villain's (lower) aircraft. Holscher later tried it again for another movie and came down with blank film in his hand camera. He relates : "Dick Grace was making the change, and when I saw him make a leap across space to a wing a full six feet away I was so shocked I forgot to take the picture. Dick made it, but I was scared silly." Holscher now owns a photo studio in Hollywood ; a much less hazardous source of income.

pulled out and clear of the spot a ground technician would throw the switch and fire the charge. All went well until I came over my target, and the angle of vision of the powder man was such that he touched it off at the moment I was directly over the charge. It bent the landing gear and my prop, and the wings were like a sieve. I either climbed or was blown up to 1,500 feet before I could level off and come down for a very wobbly landing."

*

Over our beer Frank Tomick recalled what probably will be for a long time to come the most amazing of movie flying accidents. "There was nothing particularly hard about the shot. It was almost routine. All I had to do was fly my Hisso Janny above an open car on the highway and pick off Al Wilson who would climb aboard on the landing gear. It was a simple 'chase' sequence for a thriller, and not unlike what we had done many times before.

"The night before we were to do it I picked up a newspaper and almost fell over. There was a picture of Al with bandages on his head and arms and a story telling of his nearly being killed in the stunt—which hadn't yet taken place !

"Al had rigged it up as a corny publicity stunt, and I was furious. When I finally located him I told him plenty, and said that when I picked him off the car the next day I was going to bounce his pants from one end of the adjoining bean field to the next.

"So help me, the next day, at the very instant Al grabbed the landing gear and made the change the engine in my JN started coughing and losing revs, and I did exactly what I had said, jokingly, I would do.

"I barely had power to stay off the ground as I swung clear of the highway, and it was bump, bump, bump clear across the bean field with the seat of Al's pants doing the bumping.

"I never was able to convince him, to the day he was killed, that I hadn't done it on purpose."

Our blonde waitress in evening gown was at our table again, and persuasive.

"One more ?"

"One more," said Tomick.

I couldn't help thinking of conversation with Dick Grace earlier in the evening. He had insisted that he was through with the hazards of crash sequences. But in almost the same breath he added : "Maybe I'll have just one more."

What's in the Air ?

International Air Politics

Diplomats were as busy as ever in the last six weeks. Altogether they concluded twelve bilateral civil air transport agreements and either engaged in or prepared to start talks for about twenty others. Announced also were several civil aviation disagreements, and no one knows how many there were besides.

Important accords reached included the consolidation of three previous *Anglo-Canadian pacts* into a single one on August 19th, providing for five routes to be operated to Canada by U.K. airlines, four to the U.K. by Canadian carriers. It also regulates Anglo-Canadian competition on routes to the Caribbean area.

Talks for major treaties were those resumed in Rome on August 28th by Italians and Yugoslavs, as well as those begun at New Delhi between India and Norway earlier in the month, in Washington between the U.S.A. and Argentina at the beginning of September, and those between South Africa and Italy. Important air talks were also announced for the near future between Holland and Australia, France and Britain (treaty revision), South Africa and Israel.

Principal disagreement is that over the *U.S.-Canadian bilateral treaty* signed June 4th. Colonial Airlines, which under the agreement would get stiff Canadian competition on the Montreal—New York route, has mobilized a group of Senators who now clamour that the pact is unconstitutional, together with 38 others concluded by the U.S.A., and were subject to Senate ratification. Ex-C.A.B. Chairman James M. Landis is leading Colonial's attack. Thus far the agreement has not been implemented, and in retaliation the Canadian Air Transport Board has refused traffic rights to U.S. carriers until America executes its own part of the agreement.

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Military air politics made much progress, largely because the world is definitely split into two military camps without make-believe of brotherly love. The only forum where this fundamental difference is evident is the United Nations. Thus, the French proposal for a world census of armed forces and non-atomic weapons was opposed at Lake Success by the Soviets and the Ukraine, nominally because atomic weapons would not be included, and will no doubt be vetoed by the Russians when it reaches the Security Council.

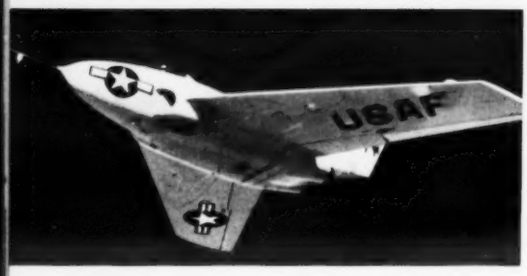
Advances in Western "regional defence" harmony have been numerous during the period under review. The major item no doubt was the *coming into force of the Atlantic Pact* on August 24th, following ratification by all participants. President Truman, deciding to strike while the iron is hot, sent a message to Congress a month earlier, on July 25th, asking for the swift approval of a $1,450,000,000 *foreign military aid programme*. Surprisingly, the message was stiffly attacked by influential groups in both Houses. By the time it was passed by the Senate Foreign Relations and Armed Services Committees September 9th, it had been watered down considerably and provided $1,000,000,000 for the North Atlantic Pact nations and various amounts for Greece, Turkey, Iran, Korea, the Philippines and China, making a total of $1,314,010,000.

*

The Soviet reply to these preparedness measures is seen in reports that the Russians are building a network of guided-missile bases pointed to Western Europe and have re-built the German missile experimental station at Peenemünde. Five single-battery launching sites are said to have been completed and six three-battery bases are reported to be under construction.

Domestic Air Politics

The biggest "let-down" for the sensation-hungry masses no doubt occurred in the domestic political field when the *Congressional investigation of the U.S.A.F.'s procurement practices concerning the Consolidated Vultee B-36* super-bomber fizzled out and collapsed like a punctured



The second Northrop X-4 transonic research aircraft is now flying at Muroc Air Force Base.

toy balloon. The inquiry opened August 9th and at the end of the month was "recessed" until October 8th. Far from showing that the big bomber had been ordered in quantity as a result of "influence," graft, bribery, fraud, collusion, dishonesty and what-have-you involving Defence Secretary Johnson, Air Force Secretary Symington, Convair Chairman Odlum and others, as the accusers had claimed, it revealed that the Air Force had bought the type only after mature reflection and the incorporation of numerous important improvements. It was also discovered that these allegations were largely based on a "anonymous" document compiled by a Navy Department employee named Cedric Worth, who later recanted. The whole affair did a lot of harm to the Navy's prestige and boosted the case of the Air Force. (The Navy opened its own inquiry to determine responsibilities.) One thing the Congressional investigation did was to reveal that both Consolidated Vultee Aircraft and Curtiss-Wright Corp. last year had approached such firms as Lockheed, North American, Northrop and Boeing with merger proposals. Neither had any luck.

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The Navy suffered another blow when Defence Secretary Johnson issued a directive on August 9th ordering the *Navy and Naval Aviation to be cut by half*. "Midway" class aircraft carriers would be reduced from eight to four, carrier air groups from fourteen to eight, Marine Corps aviation squadrons from 23 to 12, anti-sub squadrons from eight to seven, patrol squadrons from 30 to 20. Disappointed naval officers now cynically refer to themselves as the "Air Force's Salt Water Division." The curious feature of it all was that on August 14th Navy Secretary Francis P. Matthews denied knowledge of the Defence Secretary's directive. But on September 10th he admitted in Los Angeles that "a new series of reductions in the size of the U.S. armed forces" was forthcoming.

The *U.S. Air Force* did not fare very well at the hands of Congress, either. It got a moral boost on August 27th when the Senate approved the Bill providing for an *authorized* strength of 70 groups, with 24,000 serviceable aircraft of 224,000 tons airframe weight aggregate, and 502,000 personnel. In practice, however, Congress went along with President Truman's recommendation of early 1949 and cut Air Force funds for the current 1949-50 fiscal year by $800,000,000, forcing a reduction from 58 to 48 groups. The new U.S.A.F. composition will be as follows : four Convair B-36 heavy bomber groups ; ten medium bomber groups (Boeing B-29, B-50, B-47 jets) ; one light bomber group ; six strategic reconnaissance groups (including two with B-36s) ; one tactical reconnaissance group, six troop carrying groups ; twenty fighter groups.

On August 10th President Truman signed the *Military Unification Act* passed by the Senate July 28th. The Army, Navy and Air Force now become mere "military departments" under Louis A. Johnson's strengthened Defence Department, which now has Cabinet status next in rank to the State Department.

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Domestic airline politics the world over have been concerned with the continuing unfavourable financial shape of the industry.

In the U.S.A., Senator Edwin C. Johnson, active, economy-minded Chairman of the U.S. Senate Interstate and Foreign Commerce Committee, in mid-July announced his philosophy regarding the U.S. air transport industry. His Committee had been holding an inquiry into the financial troubles of the U.S. airlines, and his declaration no doubt represented a condensation of his conclusions. He forcefully insisted on greater airline operating economy to reduce or eliminate the heavy Government subsidies of the past several years. He recommended strict separation of mail and subsidy payments, mergers between airlines, consolidation of airline ticket offices, conclusion of equipment interchange agreements, expanded coach operations to tap new travel markets.

On the other side of the Atlantic, the *British Parliament* in July passed legislation handing the money-losing nationalized airways corporations a £2,400,000 hidden subsidy on a platter : "certain" large types of aircraft (the specifications apparently are designed to cover B.O.A.C.'s "Stratocruisers" and "Constellations") are exempted from import duty, which represents a £1,400,000 remission of duty this year, plus an anticipated £1,000,000 over the next eight to ten years.

The Air Transport Industry

Cheaper air travel : pro and contra

The introduction of cheap air travel to tap the hitherto latent mass market of wage earners in the lower and middle-income brackets and thus to improve the airlines' financial position continues to preoccupy airline executives and Government officials alike. However, for the moment this market "appears to remain tantalizingly just out of reach," to quote IATA Director-General Hildred's words before the 30th Annual Meeting at The Hague on September 12th. Some of the lines oppose mass-travel schemes, others carry out experiments, a few wholeheartedly support them. Outstanding among the latter is Juan Terry Trippe's Pan American World Airways. Trippe's friend, Republican Senator Owen Brewster, asserted in the second week of August that "a $150 round-trip fare to Europe would encourage mass patronage of airlines and do as much for the tourist business as Henry Ford's cheap automobile did for the automobile industry."

In this he concurred with the *Executive Committee of the Organization of Economic Cooperation*, which on July 21st began to study proposals for the establishment of cheap services on the Atlantic as a means of increasing American tourism to Europe. Financially strained European operators showed a marked lack of enthusiasm, the U.S. Civil Aeronautics Board was against the scheme, P.A.A. applauded it. The C.A.B. was not the only Government authority to look upon such plans with disfavour : the Argentine Director-General of Commercial Aviation in July refused to authorize P.A.A.'s and Panagra's reduced tourist travel tariffs to South America. Regional traffic between Argentina and Chile and between Argentina and Brazil must be reserved primarily for the airlines of these countries, the Director-General holds.

The remarkable impact of cheap "coach" services on five major U.S. airlines is brought out in a special study prepared by the C.A.B. and issued at the end of July. This showed that *two-thirds of the coach passengers would not have used air travel* if coach service had not been available. As early as spring, 1949, coach services accounted for 25 percent of Capital Airlines total passenger-miles and 20 percent of those of Northwest Airlines. Load factors on the coach services of Capital Airlines, Northwest Airlines and T.W.A. exceeded load factors on the regular schedules. However, these data have apparently not been sufficient to persuade the C.A.B. to decide that such services should continue. In the middle of September the Board merely extended by another nine months the coach and other special fare plans which would have expired September 30th.

Flying trials of the Martin XB-51 three-engined jet light bomber were due at the end of last month.

Sunny, with some clouds...

On the whole, the airline picture has been optimistic in the past six weeks—it nearly always is during the summer months. *The U.S. airline industry* announced in July, for example, that it expects to *show a profit for 1949* almost equal to its 1948 loss of $20,000,000—if traffic continues at its present high level. Upward trend in traffic and income is attributed to four factors : improved dependability, completion of purchase of and payment for post-war aircraft, greater operating economy and capacity of post-war aircraft, reduction in the ratio of non-flying to flying costs.

U.S. Defence Secretary Louis A. Johnson got a clean Bill of Health in the B-36 inquiry, announced cuts in Navy and Naval Aviation strength.

Growth in traffic volume was shown by figures issued in August. *One-third of all Americans making a journey now go by air.* During the first quarter of 1949 the airlines' share of total traffic-plus-rail passenger traffic was 33.2 percent, against 28.4 percent in the same quarter of 1948. (Bus and coach operators have suffered principal losses.) In travel of comparative luxury classes, U.S. domestic airline travel in May, 1949, for the first time on record exceeded Pullman rail travel : 603,000,000 passenger-miles for the airlines, 582,000,000 for the Pullman coaches. June air passenger-miles were also estimated to be slightly higher than Pullman travel.

Due to the recovery of European civil aviation, on the other hand, U.S. international airlines "lost some ground" on the *North Atlantic* during 1948, despite record-breaking business. While American operators still carried 75 percent of the 194,113 trans-Atlantic air passengers of 1947, this proportion dropped to 69.15 percent of the 211,139 passengers moved in 1948.

That the clouds have not disappeared from the apparently sunny airline scenery is forcibly underlined by such news as the loss by the three British airline corporations : *B.O.A.C., B.E.A.C., B.S.A.A.C.* (the first and last now merged), *are expected to report a combined loss* of £9,000,000 for the fiscal year to March 31st, 1949, compared with £11,086,909 for the preceding year. The loss occurred notwithstanding the fact that aircraft-miles during the year were up 4.6 percent, passenger-miles up 20.4 percent, mail-ton miles 16.1 percent and freight-ton miles 39.4 percent.

Airline combines

P.A.A.'s Juan Trippe has made known his intention to see through the *consolidation of American Overseas*

Airlines with his Company in the face of heavy opposition. P.A.A.'s stockholders, on the one hand, approved the deal on July 21st. On the other, opposition continues to be evident. In the middle of August, for instance, Public Counsel testified before the C.A.B. that the proposed merger would "create a substantial danger of monopoly." P.A.A.'s only remaining competitor on the Atlantic, T.W.A., "might well be compelled to withdraw." Notwithstanding this, it was announced September 13th that the merger agreement, which was due to expire September 15th, has been extended until March 31st and will be renewed by another three months if necessary. This should give P.A.A.'s opponents and the C.A.B. ample time to make up their minds. The revised agreement stipulates that P.A.A. pay for A.O.A.'s assets in cash and not in stock as provided for originally. P.A.A. will pay out $17,450,000, of which American Airlines, majority owner of A.O.A., will get about $10,800,000. P.A.A. will also assume A.O.A.'s liabilities, estimated at about $9,000,000.

An opposite tendency has become discernible in an already established combine. In the middle of July suggestions were voiced in the Norwegian Parliament that *Det Norske Luftfartselskap*, Norwegian national airline, should withdraw from *Scandinavian Airlines System* to protest against the "Cinderella roles" that had been assigned to it. This statement may have been the result of the Company's unsatisfactory financial showing during 1948 (loss of Kr. 17,073,505 against Kr. 2,586,017 for 1947). While these suggestions were vigorously denounced by Major-General Mjalmar Riiser-Larsen, Managing Director, who stated that D.N.L.'s withdrawal would cut its operations by half, a first crack in the S.A.S. structure has nevertheless been announced. On October 26th, the Swedish A.B.A. and the Danish D.D.L., acting for S.A.S., will start a service of fortnightly passenger-carrying proving flights on the Far East route from Stockholm to Bangkok. The Norwegian D.N.L. has withdrawn from the project, as a Norwegian Far East route is already being operated by Braathens SAFE, the big contract carrier.

In Europe, Britain's House of Commons has approved the Bill *merging B.S.A.A.C. with B.O.A.C.* The former will be run as an autonomous division of B.O.A.C. until traffic right transfers and similar formalities have been completed. Meanwhile, the tendency towards the formation of an Italian national airline is gaining ground. In August the Italian Government invited Avio Linee Italiane-Flotte Riunite, formed recently by the consolidation of four smaller carriers, to merge with its own Linee Aeree Transcontinentali Internazionali (LATI). The Government said the merger was a condition to be met prior to the granting of any North Atlantic operating concession. The Avio Linee people don't like the idea much, as the Government would insist on 51-percent control of the combined line.

Behind the Iron Curtain the number of Soviet-"assisted" operators has remained stationary, although some changes have taken place. On August 3rd a new joint *Russo-Bulgarian airline designated TABSO* was formed in Sofia to operate Bulgaria's domestic and international air routes. The company, which replaces the Bulgarian State airline formed in July, 1947, appears to be similar to the Russo-Hungarian Maszovlet and the Russo-Rumanian TARS.

The Nord 2500 twin-boom freighter is undergoing flight tests.

The first production model of the Northrop C-125 "Raider" assault transport made its initial flight in August.

On the other side of the Satellite airline balance sheet, the *liquidation of the Russo-Yugoslav JUSTA airline*, formed in February, 1947, was announced by the Belgrade Government on September 2nd. Negotiations initiated by the Yugoslav Government to this end were concluded August 31st. The reason is, of course, that the Russians don't love the Yugos any more, and vice-versa. JUSTA has been having trouble on the same account for some time : all domestic and most of the international services were cancelled in July because the Rumanian people's democracy refused to supply aviation gasoline to the Yugoslav people's democracy.

The Aircraft Industry

What's new in the air?

First flight honours for the last six weeks go to *Great Britain*, whose new aircraft have taken off like flies from a hot brick just before the S.B.A.C.'s Farnborough Show. They are listed elsewhere in this issue. One might add the first of the two Vickers-Armstrongs "Varsity T.1" twin-engined trainer prototypes, a development of the veteran "Viking," with a longer fuselage, bomb-aimer's "balcony," tricycle undercarriage and twin wheels.

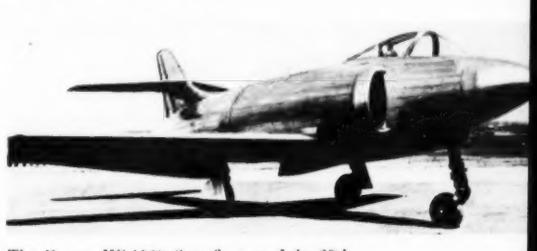
In the *U.S.A.*, Douglas Aircraft and Curtiss Wright are submitting design proposals to the U.S. Navy for a jet-propelled attack aircraft of an all-up weight of about 65,000 lbs. The projects result from the recent cancellation of the 65,000-ton aircraft carrier "United States" which would have been able to operate bombers in the 100,000-lb. class. The smaller aircraft should be capable of operating from the Navy's three 45,000-ton "Midway" class carriers.

Douglas also reports progress with its giant *C-124A* military transport. Fuselage and wing have been assembled and the first flight is scheduled for November. The U.S.A.F. is examining the possibility of converting one or more of the aircraft into flying tankers to refuel bombers and fighters in mid-air. Meanwhile, another giant U.S.A.F. aircraft, the *Consolidated Vultee B-36D*, powered by six P. & W. "Wasp Majors" and four General Electric J-47 jets of 5,200 lbs. static thrust each, has started its flying trials at Fort Worth. The recent Congressional investigation has given it a clean bill of health as an efficient aircraft. —Incidentally, the B-36's heir presumptive (or "consumptive," in view of its fuel-thirsty power plant), the eight-jet *Boeing B-52*, is now reported scheduled for production in 1954. It will carry its engines in underslung pods like the Boeing B-47. At the other end of the scale, the *Glenn L. Martin Co.* wheeled its *XB-51* three-jet experimental attack bomber from its shop in mid-September. Flying trials were set to start at the end of the month. At the end of August Martin also announced the maiden flight of the first production-type *Martin P4M-1 "Mercator"* piston-plus-jet powered patrol bomber built for the Navy. The "Mercator" has a gross weight of 80,000 lbs.-plus and a range of more than 2,000 miles. Finally, the first production model of the *Northrop C-125 "Raider"* three-engined assault transport started its flying trials early in August. The original prototype, the commercial "Pioneer," flew long ago. The "Raider" differs considerably, and extensive testing of the production type will be required.

From Buffalo comes the news that the *Bell X-2* swept-wing stainless-steel supersonic research aircraft should be ready for flight in January, 1950. It will have a Curtiss-Wright rocket motor and is claimed to be designed for a top speed of 2,250 m.p.h. at 100,000 ft. Meanwhile, the second model of the *Northrop X-4* transonic experimental type has started its flying trials at Muroc Air Force Base, California. The first has been undergoing tests there since December, 1948. To Muroc shortly will also go the second of two *Lockheed X-90* twin-jet fighter prototypes.

Consolidated Vultee Aircraft is reported to be conducting "guinea pig" tests with its *"Convair-Liner"* twin-engined transport. The company is discussing with the Allison Division of General Motors the possibility of equipping the type with Allison T-38 propeller-turbine power plants. The "Convair-Liner" would thus become America's first propeller-turbined transport (excepting, perhaps, the Douglas DC-3 which the British have experimentally equipped with Armstrong-Siddeley "Mambas"). Convair is also stated to be considering production of a *"Convair Coachliner"* accommodating 58 passengers in an unpressurized cabin. Maximum take-off gross weight would be 43,200 lbs. against 40,500 lbs. of the present "Convair-Liner."

From *France* it is reported that the *Sud-Est SE 2410* experimental twin-jet prototype is due to start its taxiing trials at Toulouse soon. The second experimental aircraft, *the SE 2415*, is under construction ; an all-weather fighter designated *SE 2421* is later to be derived from it. The second prototype of another of France's crack fighters, the *Dassault MD 450 "Ouragan" jet*, made its first flight on July 20th. The machine stayed in the air for 45 minutes, fully armed and pressurized and at full gross weight. Société des Avions Marcel Dassault has received an order for a pre-production series of 15 MD 450 "Ouragans" for the French Air Force. A production order is anticipated. Yet another single-jet prototype, the *NC 1080* of the now defunct SNCA du Centre, took the air on its maiden flight July 29th.



The Centre NC 1080 first flew on July 29th.

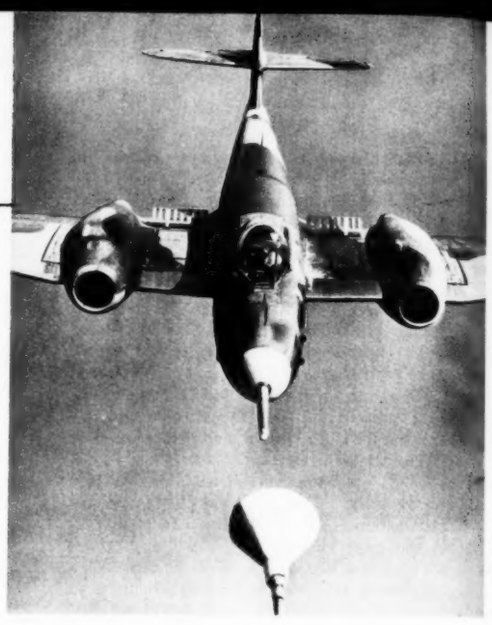
In the air transport field, the prototype of the *Nord 2500* twin-engined twin-boom freight carrier has started its flying trials.

Sweden's Svenska Aeroplan A.B. has started building a second series of the *SAAB-90A "Scandia"* twin-engined airliners, believed to be intended for K.L.M. Royal Dutch Airlines. The first of the initial ten production models of the SAAB-90A-2 on order for A.B. Aerotransport was scheduled to start its flying tests in November. Deliveries to A.B.A. are due to start in October or November. Meanwhile, the "Scandia" prototype is travelling around the Western Hemisphere on a propaganda trip.

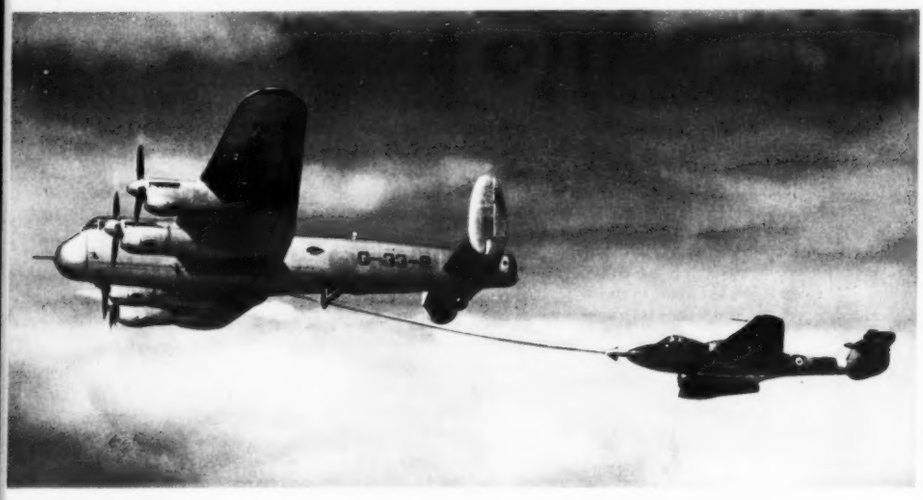
Soviet Russian reports announce the appearance of a new four-jet bomber, the *Ilyushin IL-16*. It has a straight wing of 72 ft. span and carries a three-man crew. Armament includes a remote-controlled tail-gun turret. A new fighter is the *Yakovlev Yak-17*, reportedly powered with a Rolls-Royce "Nene" or a Russian imitation. It features a nose air-intake. Finally, there is the *Yak-21* rocket fighter, said to resemble the German Me 163 or the British D.H. 108. It has a high-set elevator.

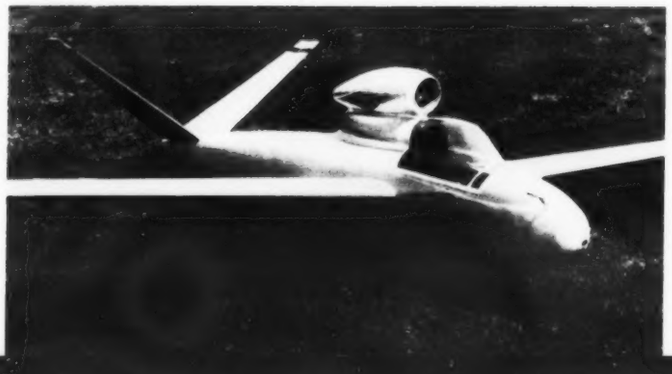
In *Poland Bronislaw Zurakowski's* helicopter was ready for flight-testing early in August. It has a two-blade main rotor and a conventional anti-torque tail rotor.

Progress in Pictures

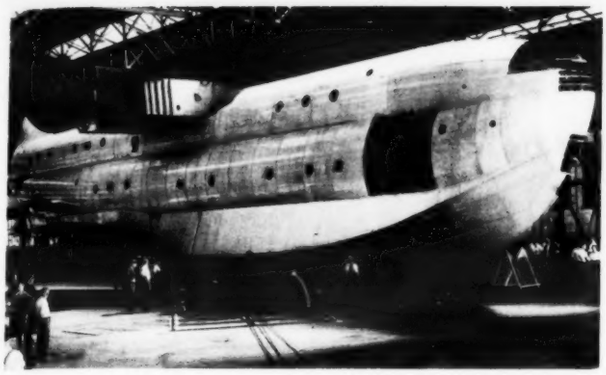


SEVERAL ONES FOR THE ROAD... enabled two Rolls-Royce "Derwent" turbojets to keep a Gloster "Meteor 2" on the wing for 12 hours 3 minutes on August 7th. The barman was an Avro "Lancaster" tanker which obligingly handed out ten drinks in flight to the thirsty jets . . . the first time a jet fighter has ever been refuelled in flight. The tanker's fuelling hose carries a "drogue," into which the jet has only to introduce its "probe" to establish the connection. About 3,000 gallons of paraffin picked up in this way during twelve hours enabled the "Meteor" to increase its range six- to sevenfold.



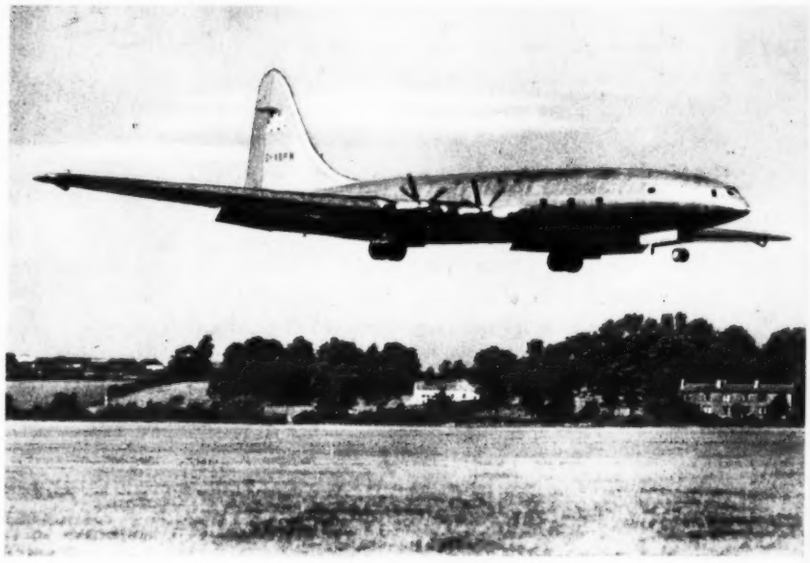


JETS IN LOUNGE SUITS made their first appearance in the de Havilland "Comet" airliner, after many years of being confined to uniforms. Two more "jet gents," perhaps less high up the social ladder than the "Comet," have now made their debut. One is the Avro "Jetliner," a commercial transport driven by four Rolls-Royce "Derwent" turbojets, which A. V. Roe & Co. (Canada) Ltd. sent into the air for the first time on August 10th. Its pressurised cabin is to accommodate up to forty passengers over short and medium distances. The other newcomer is the CM.8R-13 "Cyclone" personal and research aircraft, built in France by Fouga & Cie. and designed by a man full of bright ideas, Mr. P. Mauboussin. Its baby Turboméca turbojet engine is expected to give it a ceiling of about 35,000 feet.



TURBINE'S HORNPIPE... but danced by turboprops, not fuel-thirsty turbojets which would fail to endow civil or military flying-boats with the long range necessary for spanning great over-water distances. At Cowes, Isle of Wight, the fuselage of the first of three 140-ton Saunders-Roe SR/45 "Princess" class passenger flying-boats was recently completed; yet to come are the ten 3,200-horsepower Bristol "Proteus" propeller-turbines. On the other side of the Atlantic the prototype of Consolidated Vultee's XP5Y-1 reconnaissance and bomber flying-boat, grossing more than 60 tons, has been basking in California's sunshine, waiting for its four 5,000-horsepower Allison turboprops; by the time these lines are in print, it may have started its first flight trials.

SHE'S TOO FAT FOR... but not for "Big Bill" Pegg, Bristol Aeroplane's Chief Test Pilot who—nevertheless with the aid of 20,000 horsepower from eight engines—effortlessly lifted the Bristol 167 "Brabazon" into the air on September 4th, after a surprisingly short take-off run, and stayed up for 27 minutes. The world's biggest civil landplane, the "Brab" has roughly the same dimensions as America's Convair XL-99, though a greater wing area and more engine power.



TRAFFIC COP'S NIGHTMARE would be the U. S. Air Force's Sikorsky H-5H helicopter in its latest amphibious garb . . . enabling it to take-off from and alight on water and land with equal ease, to make a vertical or oblique ascent, and to taxi. The new amphibious landing gear, consisting of proper floats each equipped with two small wheels, instead of the previously-used nylon floats, is no revolutionary invention but nevertheless adds to the manifold abilities of this already extremely versatile aircraft.

The Air Hostess Told Us...

Off-schedule seasons

The world's inhabitants, says Our Favourite Air Hostess, follow a year-round routine, caused by the fact that the old globe revolves around the sun. What's more, the routine is crazy. If you sat in a blacked-out frigidaire throughout the year, you could still tell the season simply by listening to the news broadcasts. In winter everyone engages in febrile displays of energy, working like mad—probably to keep warm. This is reflected in the news. There follows a period of more ponderous activity, meditation and other dangerous occupations—spring has broken out. Subsequently everything slows down and finally rumbles to a full stop. This period is known as summer, often called the silly season. When things pick up and ultimately reach fever pitch once more, this means that autumn has set in and merged into winter. It happens every year.

Esmeralda now says that the silly season really is off-schedule. It doesn't happen when it is supposed to. Nobody budges during the so-called "silly season," not even to engage in any form of stupidity. The heat is too intense. The stupidity begins when the silly season ends and people begin to come out of their respective comas, somewhere between the beginning of September and the middle of October.

The proof ? Just listen, says Esmeralda.

On September 5 two Frenchmen and a French girl set out from Paris to walk (yes, walk !) to the Cape of Good Hope, a distance of 8,700 miles ; they are looking forward to hitting the border of the Union of South Africa, because they will have only 1,200 miles left to walk from there.

On September 2nd two Germans, Franz Kaminski and a friend, arrived in Hamburg after having pushed a 1,400-pound barrel from Berlin. The trip was designed to show their divided city's will for freedom. Highly effective, Esmeralda thinks.

Also on September 2nd, Korean fishermen lugged a seven-foot turtle out of the Yellow Sea, where he had spent most of his youth, estimated at 1,000 years. To fortify him, they gave him three crockfuls of Korean rice wine. He drank it all, without protest or hiccough, and came back for more. The poor thing now is in the Zoo of Seoul, which requested dietary advice from the U.S. Department of the Interior. The latter's counsel was : marine fish and no wine. The turtle was offended. Incidentally, the wine treatment seems to be the conventional reception accorded to turtles. On March 27th four rather extraordinarily large turtles waddled off an aircraft at London Airport after a flight from Trinidad. Upon arrival, they were given choice oysters and champagne to warm the cockles of their hearts (the London *News Chronicle*, reporting this memorable event, discloses the astonishing fact that turtles have three hearts ; Esmeralda's encyclopaedia points out merely that the "chelonia" has a small brain and a negligible mental capacity. Perhaps that is contagious...) A week later they were shot for the Lord Mayor's banquet.

Hold on, you will say, things are different in our trade. There's no tomfoolery in aviation, everything is carefully regulated. Come again, brother ! Some people only engage in some form of air endeavour when they are on the way to the loony bin. Take the case of Bernard MacFadden, retired physical culturist, of New York, who on August 21st climbed to 3,000 feet in a small aircraft and parachuted into an alfalfa field. He was celebrating his eighty-fifth birthday. Original, but not quite : on October 12th of last year, 76-year-old farmer Walter Morgan, of Fosston, Minn., parachuted into a potato patch from 10,000 ft., "just to show the youngsters."

Then there was Leonardo d'Attolici, who said he wanted a "bomb's eye view" of New York and on August 21st parachuted from an aircraft flying at 6,000 feet over the city. He took motion pictures until he landed on a 20-ft. chimney in mid-town Manhattan, on the corner of 38th Street and Park Avenue. Ex-paratrooper d'Attolici was met by a reception committee consisting of a police emergency truck and two police cars, who hustled him off to the nearest police station. There it was discovered that he made a similar jump at the end of the silly season two years ago, and was arrested for "littering the public highway."

Meanwhile, another threat has had the guards of New York's 1,250-ft. Empire State Building jumpy (another kind of "jumpy," however) since September 1st. A certain Robert Niles, who parachuted off the 225-ft. Washington Bridge on August 31st and who had previously made leaps from two bridges in San Francisco, announced that he would jump from the 102-storey Empire State with his girl friend, Vicki Gray of Los Angeles, in his arms. If he couldn't jump off the roof because of the guards, he said, he'd jump out of a window. Nice prospect for the numerous office workers in the place. Imagine it : an office door suddenly bursts open, a man with a girl in his arms strides in and takes a flying leap out of the window next to your desk ! This feat accomplished, he plans to jump off the Eiffel Tower in Paris.

Now she understands, says Esmeralda, why there are not many tall buildings in Europe. In her age-old wisdom, Europe had foreseen the threat they might constitute. Still, there ought to be a law in the U.S.A. : if this goes on, New York will soon look like Moscow on Soviet Aviation Day...

See what I mean ? asks Our Favourite Air Hostess ; the world goes nuts when the silly season has ended. If you're not satisfied, listen to the reports of the "flying eggs" (the saucers have gone out of fashion) of Los Angeles of September 1st, the incredible story of forty-four homesick war brides who chartered an airliner on August 31st to fly from California back home to Mama in England, mostly with newly acquired kids who were sick most of the way.

And if you're still not convinced, ask the BOAC staff at New Delhi who were nearly driven out of their minds on September 6th. The reason ? The company's local offices were populated by 170 monkeys and 24 giant bats airbound for Karachi. They were stranded there because a pickpocket had stolen the health certificates from their owner's pocket... Working in the middle of fantastic noises and odours, BOAC's staff at this writing are hoping that the owner will get a duplicate soon.

Research at Work

(Conclusion)*

Transonic aerodynamics

Investigations of the complex flow processes occurring in the transonic domain (approximately between Mach 0.8 and 1.2) meet with extraordinary difficulties. Wind-tunnel tests, because of the shock waves occurring perpendicular to the direction of flow at sonic speed, and their reflection by the tunnels walls, can be conducted only in high-speed subsonic installations which on one side have a curved flow-deviating surface (" wind-tunnel bump ") for creating a local sonic or supersonic flow (Fig. 8), and consequently only on very small models. Otherwise tests are made with free-falling bodies and rocket-propelled models, which naturally require expensive recording or telemetering devices ; models are made to rotate at sonic speed ; or placed on rocket-driven vehicles running along rails, a method used by Northrop and ONERA (Fig. 9). In this way the mysterious region of the mixed local supersonic and subsonic flows can be narrowed down more and more. All the same, nearly all the reports on this research are tucked away in safes and are therefore hidden from the public.

For a theoretical approach to the problem, however, Busemann's recent suggestion [1] that it be divided into :

a) mixed subsonic flow (with local supersonic enclosures), approx. Mach 0.8 to 1.0, and

b) mixed supersonic flow (with local subsonic enclosures), Mach 1.0 to approx. 1.2,

should offer valuable help. The local " enclosures " are divided off from the main flow by so-called " sonic lines," along which the pressure, density, temperature (and therefore speed of sound) of the flowing medium remain constant and in the so-called critical or sonic state (Fig. 10). They arise when the flow immediately adjacent to the body undergoes, as a result of the body's shape, a change in cross-section such that the sonic limit of the main flow is *(a)* exceeded or *(b)* fallen short of. In consequence the laws relative to the main flow would be reserved for the enclosures ; however, it appears that there occurs a spontaneous, local change in density of the flowing medium, due to heat processes.

In view of the enormous importance of this detailed research, upon which depends not only the flying safety of supersonic aircraft but also that of subsonic aircraft which may exceed the critical Mach number in dives, NACA decided in 1948 to establish a Special Sub-Committee on the Research Problems of Transonic Aircraft Design. In his annual report to the U.S. Congress at the end of 1948, the Chairman of NACA, Jerome C. Hunsaker, said of this subject :

> *Fear of an unknown sonic barrier has been dispelled by a better knowledge of the problems of transonic flight. Moreover, it now appears possible to build aircraft which can be safely controlled within the transonic region.*

Propeller and rotor aerodynamics

It is surprising to note how much attention has still to be devoted to propellers. For example, no less than thirty of the British

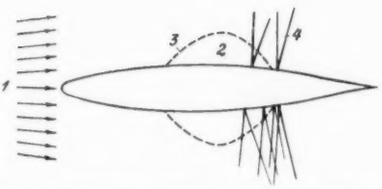


Fig. 10 : Examples of local supersonic enclosures in high-speed subsonic flow over a laminar wing. Such zones can severely prejudice control-surface power in high-speed flight.

1) Subsonic flow
2) Supersonic enclosures
3) Sonic lines
4) Shock waves made visible by Schlieren photography

Aeronautical Council's last three hundred reports are concerned with this subject : blade section lift and drag characteristics—mostly of Clark Y and R.A.F. 6 sections—are calculated and measured for different blade settings and advance ratios (R. & M. 2020, 2035, 2038, among others) ; concomitantly, propeller thrust, torque requirement and efficiency are investigated and ascertained for all operational conditions and flying altitudes likely to arise, this for single-rotating (R. & M. 2086, 2092) and contra-rotating propellers (R. & M. 2051, 2216-2220, 2270) ; observations are made of flutter characteristics (R. & M. 2047, 2054, 2073) ; and so forth. Owing to centrifugal action on the boundary layer the flow processes in connection with propellers are primarily three-dimensional in nature, depend on the airflow speed and blade r.p.m., and can be ascertained accurately only in the wind tunnel or during flight. Recent U.S. research has been concerned with thrust gains by means of superior shank fairing

* INTERAVIA, Review of World Aviation, Vol. IV, No. 4, pp. 561-564.

[1] Journal of the Aeronautical Sciences, June, 1494, pp. 337-399.

Fig. 8 : For testing small models at the speed of sound (Mach 0.8 to 1.15), Lockheed engineers developed this " bump " for the Southern California Cooperative Wind Tunnel at the California Institute of Technology in Pasadena, Cal.

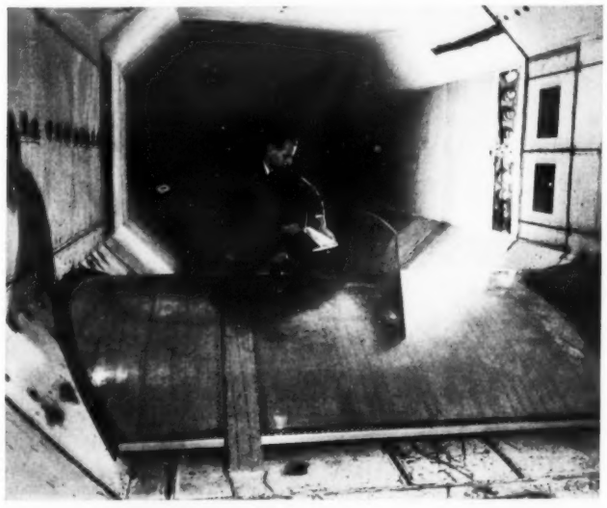
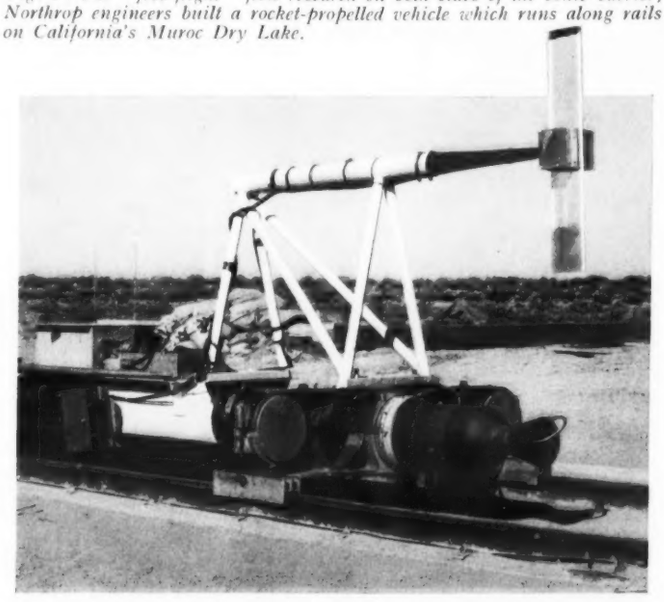


Fig. 9 : For " free-flight " flow research on both sides of the sonic barrier, Northrop engineers built a rocket-propelled vehicle which runs along rails on California's Muroc Dry Lake.



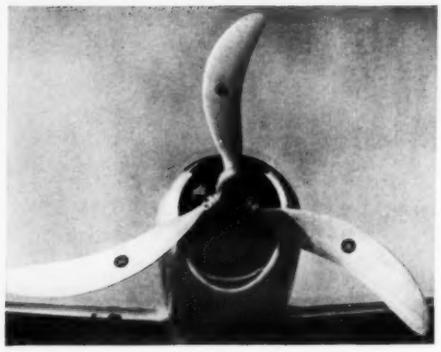
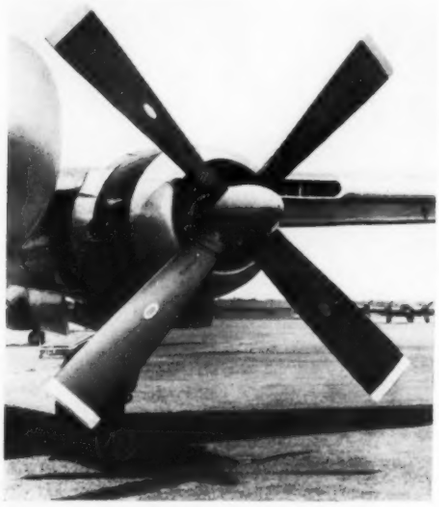


Fig. 11 : Curtiss-Wright experimental propeller with crescent-shaped blades for high Mach numbers.

(T.N. 1414), differing pitch distribution (T.N.1634), and also with noise reduction (T.N. 1654, etc.). Other research includes investigations of windmilling propellers and studies of braking action by reversing the pitch and opening the throttle (*e.g.*, R. & M. 2228).

The reason for all this research becomes more apparent when one considers the importance of propeller efficiency to flight performance and economy, and the difficulties encountered at great altitudes by modern high-speed aircraft powered by big reciprocating engines or propeller-turbines. What applies to aircraft wings in only exceptional circumstances, applies to propellers in nearly all operational conditions : their essential portions move at close to sonic speed. For local airflow speeds, however — apart from the r.p.m. and diameter — the flying speed itself is decisive ; and precisely this has increased enormously in recent years. In addition, big airliners nowadays fly regularly at altitudes between 6,000 and 9,000 metres, where the speed of sound is 7 to 11 per cent. lower than at sea level and, accordingly, the critical Mach number is attained sooner. Finally, there comes the fact that increasingly greater engine power has to be absorbed by propellers of limited diameter, so that the propellers have to work with greater blade numbers and angles (power losses).

Fig. 12 : Hamilton-Standard " Turbo-Hydromatic " propeller with trapezoidal laminar blades for high engine outputs (gas turbines) being tested on a twin-row radial.



With a view to improving the critical Mach number, research on propellers at first followed much the same pattern as that on aircraft wings, on the one hand by reducing the section thickness (R. & M. 2036), on the other by using swept-back or crescent-shaped blades (Fig. 11). Recently, laminar sections have found their way into propellers. Thin laminar sections at the blade tips enable rectangular or even trapezoidal plan-forms to be used, making greater power absorption possible (Fig. 12).

Finally, it should be remembered that propellers, too, seem now to be offered the possibility of crossing the sonic barrier ; the resultant advantages as regards greater engine power absorption (eventually in conjunction with gas turbines without reduction gear) are obvious. That which applies for the supersonic wing must after all be applicable to the propeller ! There is already mention, in NACA circles, of supersonic propellers featuring " delta " blades, with pitch/diameter ratios of six or more to one, making possible flying speeds of up to 2,400 kms./hr. A research report has also been issued on this subject (T.N. 1303). Moreover, Curtiss-Wright has referred to development work on supersonic propellers for subsonic and supersonic aircraft.

Though it is not a very great mental jump from the propeller to the rotor of the rotary-wing aircraft, there is nevertheless the essential difference that rotors mostly receive the airflow obliquely to their axes and, for reasons of safety (autorotative landings), are subject to very much smaller disc loadings — *i.e.*, they feature a larger diameter and turn at less r.p.m. Furthermore, rotor blades are frequently attached to their shaft with two degrees of freedom and require complicated adjustment mechanisms. Nevertheless, it has been possible to acquire many facts from propeller theory and apply them usefully to rotors. In order to supplement the theory it has been necessary to devise expensive test beds (Fig. 13) which enable such values as rotor thrust, torque requirement, blade angles, flapping and rocking angles, control forces, etc. to be measured, with electrical and optical instruments, on full-scale models at different r.p.m. rates. In the U.S.A. rotor theories are investigated by means of measurements effected during powered flight and autorotation (T.N. 1595, 1666) and the influences ascertained of different plan-forms, aerofoil sections and the pitch variation on hovering performance (T. N. 1542). Mention might also be made of U.S. work on rotating-wing parachutes (Fig. 14).

Surprisingly, it has been seen from some rotors that the aerodynamical limit on forward speed depends not upon the critical Mach number of the advancing blade tips but upon the periodic break-away of flow on the returning blades (owing to the temporary increase of the pitch angle and the forward tilting of the rotor plane). Progress must therefore be sought in the direction of smaller effective blade angles, whereby chances are offered by the Gyrodyne principle on the one hand, and by jet-driven rotors on the other. Precisely in conjunction with jet propulsion—with either pressure nozzles or ramjets at the blade tips—it may well be imagined that even helicopter rotors may cross the sonic barrier in the not-too-distant future.

Exploring the upper air levels

Up to a few years ago the composition, temperature and pressure variations of the earth's gaseous atmosphere were known to an altitude of only about 30 kms., thus the maximum altitude attainable with sounding balloons. For the zone of the lower stratosphere (about 10 to 30 kms. altitude) it was ascertained that the composition of its air approximates the conditions in ground vicinity, that its temperature remains constant at about — 60 deg. C. (consequently yielding a constant speed of sound of 1,065 kms./hr.), whilst the air pressure drops from about

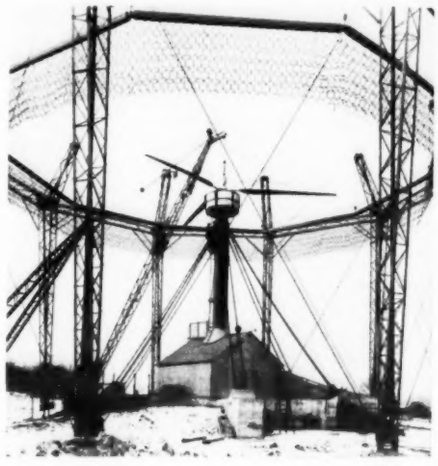


Fig. 13 : The Bristol Aeroplane Company's helicopter testing facilities enable full-scale rotors to be tested.

2,600 kgs./sq.m. (191 mm. Hg) at 10 kms. altitude to 110 kgs./sq.m. (8 mm. Hg) at 30 kms. altitude. The air density, which decides the dynamic pressure, can then be calculated by the familiar laws of dynamics.

It required the advances in rocket technique made in World War II before sounding rockets carrying recording devices which were let down by parachute (Fig. 14), or equipped with automatic UHF transmitters for sending information back to earth, were fired to altitudes up to 400 kms., thereby making it possible to explore the upper stratosphere (up to 75 kms.) and the subsequent ionosphere (up to 400 kms.). Oddly, it was discovered that the temperatures between 30 and 60 kms. rose sharply, occasionally to + 100 deg. C. (coupled with a corresponding increase in the speed of sound), owing to the presence of ozone in the upper levels. At about 70 kms. altitude the ozone layer ceases and the temperature begins to fall anew to values below zero, though it rises quickly again to + 100 deg. C., and even to + 300 deg. C., in the ionised " Kennelly-Heaviside E-Layer " (at 120 kms. altitude). It is likely that analogous processes are repeated before and in the somewhat higher and likewise ionised " F-Layer," *i.e.*, between 200 and 400 kms. altitude. In actual cosmic space the temperature may fall to absolute zero (— 273 deg. C.), as it is not known whether there are any particles of matter present for taking up the heat of the sun. For extreme altitudes, in place of the air density, the molecule's mean free path (or else the number of molecules per

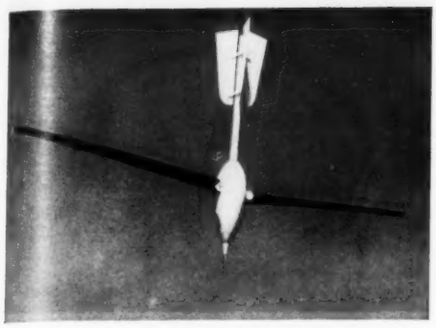


Fig. 14 : The recording equipment of a V-2 sounding rocket returns to earth from 160 kms. altitude with valuable data. Ejected at the V-2's apogee, it attains supersonic speed during its free fall ; then a rotating-wing parachute, constructed by General Electric, opens out and decelerates the speed to 40 kms./hr.

unit volume) is given. While this amounts to about 1/10,000 mm. in ground vicinity, it attains 7/1,000 mm. at 30 kms. altitude, 7 mm. already at 90 kms., and is of the order of kilometres at altitudes of over 200 kms. Exact knowledge of these air density and temperature variations is extremely important for calculating the skin temperatures of rockets and aircraft, or the thrust output of ramjet motors. Also important to high-altitude aviation is the increase in wind speed, due to the earth's rotation, which has been ascertained for the lower and medium stratosphere.

In its T.N. 1200 the NACA Special Sub-Committee on the Upper Atmosphere worked out proposals for a " standard upper atmosphere," which were based on indirect measurements. In recent years these have been reviewed in the light of high-altitude temperature and pressure measurements becoming available from soundings by V-2 and " Wac Corporal " high-altitude rockets. Though the latter have yielded measurements which differ in part, NACA nevertheless considers it inadvisable to attempt any revision of the original tentative standard, owing to uncertainties that still exist in the methods of measurement (A.R. 1948). Meanwhile, some interest is earned by current rocket ascents for establishing new data on cosmic rays at high altitude (and their lethal effects). The U.S. Navy is conducting such experiments with Douglas-Aerojet " Aerobee " research rockets. In conclusion, mention is made of the very recent idea of making gust measurements in the upper troposphere and lower stratosphere, which are designed to furnish reliable data for strength calculations on modern high-speed airliners.

Thermodynamics

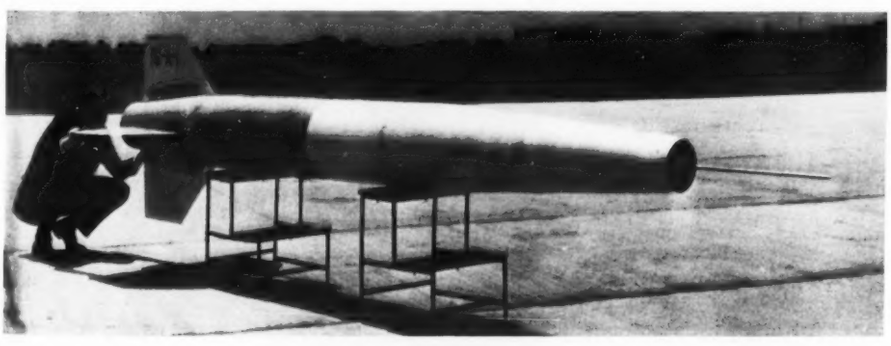
Whereas, up to a few years ago, heat physics in aeronautics was confined to a matter-of-course main rôle of furnishing basic data on aero engines, nowadays it must even be given priority over flow research, which in many respects has become dependent on it. The latter science is moving ever further away from its classical fundamentals—regarding flowing air as a homogeneous fluid and taking account only of the ratio of the flowing medium's inertia to its kinematic viscosity (Reynolds Criterion). For instance, research on high-speed flight now borders on the domain of thermodynamics, for the all-important speed of sound (Mach number) depends upon thermal conditions, and shock waves are inevitably accompanied by heat generation. High-speed aero engines of recent years, thus turbojets and ramjets, confront the theory with a Giordian knot of inter-connected aerodynamic and thermodynamic problems. As soon as flying speeds have been stepped up to more than thrice sonic speed, as soon as flights at extreme altitudes (under conditions of long molecular mean free paths) and in either very high or very low temperatures have to be studied, then flow research will be made completely subordinate to thermodynamics.

A comprehensive solution seems to be offered by the Kinetic Theory, which derives all heat and flow processes from the motion of the gas molecules. It explains static pressure from the collision of gas particles on the walls, the molecular speed as depending solely upon the square root of the absolute temperature, sonic speed as a fraction of the molecular speed, and so forth. There is already talk of " Ultra-Aerodynamics " or " Molecular Aerodynamics " (see ONERA Bulletin Nos. 7 and 8), and a transition from classical mechanics to the Quantum Theory is revealed in this field.

In the narrower domain of power-plant research, studies are naturally channelled according to the different types of engine. In the case of reciprocating and gas-turbine engines, power augmentation, notably at the take-off, and consumption reduction still claim priority attention. The methods used have much in common : piston-cooling (R. & M. 2173) corresponds to turbine-blade cooling by means of secondary air [2] or liquids (A.R. 1948) ; water-methanol injection into the supercharger to that in the axial or radial compressor. Even research on afterburning in turbojets (A.R. 1948) finds its counterpart in reciprocating engines for high-speed aircraft (R. & M. 2147), although it may not find practical application there. In endeavours to make use of the heat energy flowing out with the exhaust gases, we find on the one hand compound reciprocating engines with several exhaust gas-turbines coupled to the crankshaft (Wright " Turbo-Cyclone 18 ") or jet nozzles and exhaust turbo-superchargers (Pratt & Whitney " Wasp Major VDT "), and on the other hand heat-exchangers for turbine engines (Ritz system ; see Adderley [2]), which result in a considerable reduction of fuel consumption. Heat flow measurements in piston engines (R. & M. 2171, 2172), combustion research on the knock-limited performance of fuel components necessary to produce fuels above a performance number of 115/145 (T.N. 1374, 1416) and on turbojet fuels suitable for short combustion chambers (T.N. 1609), tests of heat-resistant metallic and ceramic materials, lubrication and detrition tests at especially high (or low) ambient temperatures, altitude tests of ignition systems, etc., continually improve the reliability, life and economics of power plants.

As regards rocket and ramjet engines, testing of new propellants is a long way from being completed. Rocket propellants must above all furnish great amounts of chemical energy coupled with combustion products of low molecular weight, and additionally entail lower manufacturing costs than hitherto. Fuels for ramjets must burn with great rapidly, in order to be able to keep pace with the attainable flying speeds. Alongside such chemical studies, detailed thermodynamic research is being conducted on combustion chambers and nozzles. Thrust measurements on test benches—recently additionally controlled by means of colour television—are supplemented by numerous ascents in the case of rockets (equipped with telemetering equipment) or drop and free-flight tests for ramjet engines (Fig. 15).

Fig. 15 : A NACA ramjet engine of 0.4 m. diameter attained speeds up to 2,600 kms./hr. in drop tests.



Structural analysis

This field embraces several sectors of applied research. For the determination of loading conditions comes equally as much under this heading as the analysis of the distribution of forces up to the final local stresses (and strains) and general deflections. Detailed studies of the properties of materials and sections furnish theoretical fundamentals for calculating ; structural strength tests on the test frame enable such calculations to be verified. Besides research on oscillation, vibration and flutter in major components, dynamic (fatigue) testing of structural elements is gaining in importance.

Logically, the determination of loads and load distribution is advancing alongside the progress being made in aerodynamics. Such innovations as swept wings (T.N. 1476, 1491, 1528), delta wings, leading-edge flaps, etc., or flight manoeuvres at high speed (*e.g.*, T.N. 1483, 1539, 1504), are therefore examined in detail, in the wind tunnel

[2] INTERAVIA, Review of World Aviation, Vol. IV, No. 8, pp. 484-488 : " Thrust Augmentation in Turbojets," by H. Oestrich ; and " German Gas Turbine Developments during the period 1939-1945," by J. W. Adderley, published in 1949 by H. M. Stationery Office.

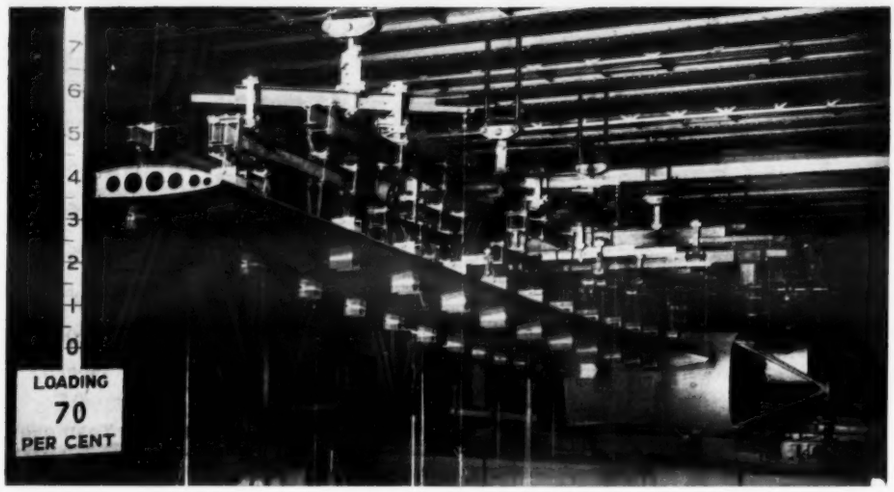
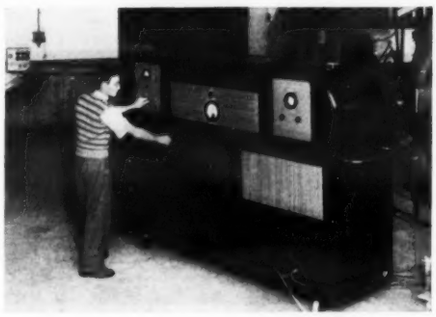


Fig. 16 : The hydraulic-mechanical test frame of the Royal Aircraft Establishment in Farnborough allows for precise distribution and step-by-step increase of the loads. High-speed recording gear picks up the values from up to 600 resistance wire strain gauges within ten seconds.



and in flight, as regards magnitude and distribution of loads on wings and control surfaces. For instance, the Bell X-1 high-speed research aircraft enabled considerable data to be obtained, in flight above and below sonic speed, on wing and tail loads (A.R. 1948). At the same time progress is being made in the determination of landing loads (drop tests of undercarriages) and hydrodynamic impact loads in the case of seaplane hulls (T.N. 1516, 1630, and others). Finally, research is occupied with problems of thermal stresses, notably those arising between the aerodynamically heated skin (additionally heated by a hotter boundary layer) and the relatively cold internal structure of aircraft diving at high speed from a great altitude (T.N. 1675).

As a result of the present-day almost exclusive use of thin-walled monocoque structures, structural analysis is chiefly concerned with stability problems relating to whole panels of the supporting structure. Generally applicable investigations are mostly concerned with simplified cases—flat rectangular plates and cylindrical shells under axial compression (R. & M. 2041, 2190), regularly reinforced flat sheet and box-beams under bending strain (R. & M. 2038, 2098, 2099), thin plates under transverse pressure due to pressurised cabins or to aerodynamic suction (R. & M. 2094), and stress concentration in monocoque structures due to rectangular cut-outs or regularly distributed fixing points (R. & M. 2135, 2100)—and even then are greatly complicated by mathematical considerations, so that the engineers are apt to prefer to rely on their familiar structural values and empirical strength tests. Accordingly, test methods have been devised which do not damage the objects under examination, and have therefore largely ousted costly strength testing until failure.

The most important of these methods, strain measurement by means of electrical resistance wire strain gauges, was recently explained in these pages, together with its manifold applications (measurement of static and dynamic strains, displacements, stresses and pressure).[3] Practical examples of measurements executed on wings and fuselages are given in R. & M. 2129, 2134 and 2163. They show that, by using several hundred strain gauges in appropriate positions, an extremely accurate strain and stress distribution can be determined, which would not be feasible through mere calculation. Meanwhile, this requires high-speed recording gear and hydraulic-mechanical test frames which allow for testing under varying partial-load conditions (Fig. 16). Another procedure, known as the "cracking-varnish process," involves the object's being given a thin coating of resin which cracks under the influence of strains and enables both qualitative and approximate quantitative conclusions to be drawn (C. I. 1949).

Aeroelasticity investigations, chiefly on torsional stiffness, have assumed increased significance in relation to high-speed aircraft and the use of swept-back and swept-forward wings (R. & M. 2208). Aerodynamic forces augment with the angle of attack and—apart from aggravating influences of compressibility—the square of the flying speed, whilst the counteracting structural forces are independent of the speed, being dependent only on deformation. The position of the elastic axis relative to the centre of pressure, and plan-form and stiffness of the wing (or control surface), define certain critical speeds which must not be exceeded, as, in the case of so-called divergence speed, even the smallest torsional deformation will increase to the point of structural failure, or, in the case of aileron reversal speed, stick movements will occasion reversed manoeuvres.[4] Sweep-back considerably increases the divergence speed, whereas sweep-forward causes it to drop rapidly (T.N. 1680). As regards high-speed flight performance, local stiffness of the skin, with a view to obtaining a smooth surface, is also of importance (R. & M. 2193).

In addition to these static effects of stiffness, tests are continually proceeding on their dynamic influences (wing and control-surface flutter). NACA conducts such tests in its own flutter tunnel (Langley Field) and also in free-flight trials with rocket-driven models at supersonic speeds (A.R. 1948). Flutter of control surfaces in the transonic speed range has today become a serious problem. Traditional criterions for the prevention of wing flexure-torsion flutter have been improved by the introduction of compressibility corrections (R. & M. 2154), and the well-known method of resonance testing on the ground, with the aircraft adequately loaded and fuelled, has been supplemented by electronic pick-ups and cathode-ray tubes (R. & M. 2155). Other research reports are concerned with propeller flutter—which can be thoroughly analysed with the aid of electrical resistance strain gauges (R. & M. 2072)—and vibration problems in gas turbines, centrifugal and axial compressors, primarily to investigate the blade oscillations forming a major problem in the design of turbojets and turboprops (R. & M. 2226).

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In the paragraphs above we have considered only the narrower domains of aeronautical research—those which provide the most emphatic signs of progress. A survey of the newer field of electrophysics which, beginning with aircraft equipment (radio-navigation, automatic control, electronic power-plant regulation, electrical auxiliaries, etc.) and extending to modern manufacturing processes (high-frequency heating by induction or di-electrical losses, electric welding, electronic control of machine tools, etc.), has penetrated into all the domains of aeronautical engineering, would be beyond the scope of the present article. Likewise, a discussion on the progress made in optics and acoustics (target-seeking devices, infrared drying processes, spectral and ultrasonic analyses, noise reduction, etc.), nuclear physics, aero-medicine, and investigation of materials must be sacrificed for the sake of brevity, though not in denial of their sometimes decisive influence in many fields of applied research.

In this article the individual sciences have set the pattern. There is no denying that specialisation has brought forth desirable results in science. But every technological realisation is accompanied by a plethora of particular problems, in each case calling for an intensive grouping and combination of all the separate scientific facts.

[3] INTERAVIA, Review of World Aviation, Vol. IV, No. 1, pp. 27-29, and No. 2, pp. 87-88 : "Resistance Wire Strain Gauges and Their Application," by Walter Ramberg.

[4] INTERAVIA, Review of World Aviation, Vol. III, No. 9, pp. 209-210 : "Rigidity Problems in High-Speed Flight."

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